THE

ELECTRICAL REVIEW.

VOL. LXXI. OCTOBER 4, 1912. No. 1,819.

ELECTRICAL REVIEW.

Vol. LXXI.] CONTENTS: October 4, 1912. [No. 1,819.

	Page
The London Tramway Problem	521
Unity House	522
Notice to Terminate a Contract of Service	522
New Zealand Contracts	523
Notes from Canada	523
Notes on the Economical Running of Low-Pressure Turbines	524
The Municipal Tramways Conference (*concluded*)	525
Rail Corrugation	926
Electrical Installation at the Wesleyan Methodist Hall	527
Electrical Trade Competition in Australia	528
The British Association.—V:—	
The Hysteresis Loss in Iron due to a Combined Pulsating and Rotating Magnetic Field	529
Experiments for Improving the Construction of Practical Standards for Electrical Measurements	529
The Determination of the Stresses in Springs (*illus.*)	529
The Water-Power Possibilities of the Highlands	530
The Transmission of Heat (*illus.*)	530
A New Machine for Alternating Load Tests (*illus.*)	531
Gaseous Explosions	532
Papers read at the B.A.	533
New Electrical Devices, Fittings and Plant (*illus.*)	533
Correspondence:—	
Is Electric Cooking proceeding on Sound Lines?	535
Knife Switches	535
Switchboard Fires	536
New Zealand Government Contracts	536
Business Notes	536
Notes	544
City Notes	546
Stocks and Shares	547
Electric Tramway and Railway Traffic Returns	548
Share List of Electrical Companies	549
Metal Market.—Fluctuations in September	551
A New Type of Insulator	551
Agricultural Applications of Electricity (*illus.*)	552
Buying Departments	553
Reviews	554
The Present Position of Electricity Supply Undertakings in Victoria, Australia	555
A New Metal-Vapour Lamp with a White Light (*illus.*)	556
Abandonment of a Contract	557
National Insurance Act, 1911	558
The Slagging Type of Gas Producer	559
New Patents Applied For, 1912	560
Abstracts of Published Specifications	560

Contractors' Column ... Advertisement pages xxii and xxiv

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 16, Palmerston Buildings, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 43, N.W. 7.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto I° 307.
SYDNEY: The Mining & Engineering Review, 2, Hunter Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE LONDON TRAMWAY PROBLEM.

A WEEK has now passed since the conclusion of the West Ham Conference of the Municipal Tramways Association, the delegates to which will doubtless ere this have resumed their accustomed chairs by their own firesides.

Not much of strictly engineering interest was included in the business of this year's Convention, except the important contribution on the subject of corrugation contained in the interim report of the Corrugation Committee, to which we refer elsewhere in this issue, and the visits to the instructive little exhibition of modern tramway appliances and material which is now such an attractive feature of these Conventions. Yet these annual reunions afford a valuable insight into the general state of mind of the municipal tramway fraternity, which, after all, exercises paramount influence on the street traffic problems of Great Britain.

In view of this fact, which cannot, we think, be reasonably disputed, it is surprising and even regrettable that the spectre of the motor-'bus should have so frequently intruded at meetings mainly composed of provincial tramway men, who have really little to fear from such a competitor. For brief reflection will show that the London area and its street traffic problems have no counterpart in provincial centres of population, where, moreover, the Corporations, unlike the London boroughs, are in the happy position of being able, in any event, to control the vehicular traffic in their own streets.

Amidst the mass of contrary opinion to which the situation in London has given rise in the extremist Press of the metropolis, one welcomes the sane and reasonable views of one paper—the *Pall Mall Gazette*—which says, in a recent editorial, that "the tramway has certain merits, which it will take long for any other species of street travel to emulate. Its steady running and its excellent lighting are comforts to which the Londoner who has to make long daily journeys cannot be insusceptible. But the motor-'bus has the advantage of being able to cover territory from which the antiquity of our street planning debars the access of tramlines, and it is hard to think of what the metropolis would do to-day if its ministrations were suddenly brought to an end. In short, we require both facilities, and all outstanding questions of conditions of running and contributions to street maintenance are of a plain business character, which gives no legitimate outlet for passion."

The position could not be more clearly stated; tramways in the principal city and West End thoroughfares are almost unthinkable, while the nearest alternative—shallow tramways under the roads—suffers from objections on the score of cost and inconvenience, as compared with the surface vehicle, which caters for the roadside passenger.

While certain North and South connecting routes through the City may be a technical necessity for the L.C.C. tramways, it must be remembered that this system is already weighed

down with unremunerative capital expenditure to an extent probably unequalled the world over, and that notwithstanding this it would probably have been financially prosperous if it had been run on more businesslike and less philanthropic lines.

Had this been the case, it is likely that the advent of the motor-'bus, except as regards its effect on road maintenance, would have been regarded with equanimity.

The question of increased road maintenance is another thorny problem which some people would apparently prefer to treat as being confined to the tramway and omnibus.

It is estimated that the London road authorities already filch the equivalent of some £120,000 per annum from the tramway authorities in respect of road maintenance, the greater part of which should legitimately fall on other shoulders, while the omnibus companies pay something like £40 per annum per vehicle in taxation, none of which apparently finds its way to the maintenance of the roads used by them, and the pros and cons of these two cases are discussed without reference to the general growth of heavy vehicular traffic all round, and the unsuitability of the roads of 10 years ago for the traffic of to-day.

While it is quite evident that the tramways are unfairly taxed for road maintenance in comparison with other forms of traffic, it is equally clear that the problem of road maintenance teems with as many difficulties as the traffic problem with which some people are in the habit of confusing it.

Unity House.

We have frequently had occasion in these columns to inveigh against the methods of the more militant among Trade Unionists. Fundamentally, the be-all and the end-all of their existence appears to be to wage perpetual war against all that is included in the word Capital, and to teach the worker to feel that Capital—represented by the employer—is his hereditary enemy. Another great principle of Trade Unionism appears to be "work for all"—not work and reward according to merit and ability, but work for all. Your Labour leader does not hold with the doctrine, "To each according to his sacrifice"; "To each according to his need" is a much more attractive formula to him whose need is very great and capacity for work very small.

So long as the strike is used as a weapon against the capitalist, and so long as the "picket" is posted to aid in the prosecution of an ordinary strike, both strike and picket are popular amongst the votaries of labour; but it is a little awkward when a Trade Union is the employer. Yet pickets have recently been placed at the door of one of the largest Trade Unions in England, for the purpose of enforcing a demand for Trade Union wages! The story—which has recently been fully told in the columns of the daily papers—is very simple. The Amalgamated Society of Railway Servants engaged 14 men—themselves railway servants—to act as clerks to assist in the labour imposed upon the Society by the Insurance Act. These men were offered 30s. a week. They demanded the Trade Union rate for clerks, namely, 35s. This was refused on the express ground that the men were not worth more than 30s. All the men were members of the Amalgamated Society; two of them were branch secretaries. Incensed at their conduct, the head office demanded their expulsion, whereupon they proceeded to picket Unity House, in order, we suppose (to use the language of the statute), to "communicate information" to persons who might apply for the lucrative office of clerk! The quarrel resulted in the Society advertising for clerks at 35s., making it a condition of employment that they should join the Amalgamated Society as members of an approved society under the Insurance Act. It might be mentioned, in passing, that to make it a condition of employment is contrary to the regulations of the Commissioners, and the Amalgamated Society has itself protested against an attempt at compulsion on the part of a railway company!

If anything were calculated to shake the confidence of the working man in the methods of Trade Unionism, this simple story ought to be sufficient. They now have an opportunity of seeing their own weapons turned against themselves in the capacity of employers. Those who run the Amalgamated Society, with a creditable business instinct, do not see why 35s. should be paid for what ought to be done for 30s. They have sought to disregard the minimum wage fixed by another Union. Can they hereafter be heard to complain if employers make the same reasonable protest against payment of enhanced wages to railway servants?

John Stuart Mill, whom we have quoted with advantage on many recent occasions, stated in his "Principles of Political Economy" (Book V, Chap. XI, par. 3) that "Experience proves that the depositories of power, who are mere delegates of the people, that is of a majority, are quite as ready (where they think they can count on popular support) as any organs of oligarchy, to assume arbitrary power, and encroach unduly on the liberty of private life." The "popular support," upon which the rulers of Unity House thought they could rely was, of course, the support of the members of a Union. "This," they said, "is a matter which touches the pockets of our members. We must study economy in the management of the affairs of the Union, or we shall run grave risks of being superseded." By an accident, their sweating methods have in this instance been dragged into the light of day. It is no very large assumption that similar forms of economy are practised by other Unions who own palatial offices in various parts of the country.

We have always had it in the back of our minds that the working man is ready and willing to drive a good bargain if he has the power to do it.

All the cruel words which have been uttered with regard to the capitalist during the last 10 years may now be applied to those in power at "Unity House." These men who are content to dislocate the entire railway traffic of the country because one mileman on a branch railway is paid less than the Trade Union rate of wages, decline to pay a clerk 35s. a week for the very extraordinary reason that he is not worth more than 30s.

They seem to scatter consistency to the winds; at any rate, the incident bears witness that the Trade Union leaders will not be consistent unless it happens to suit their policy for the moment. Theirs appears to be the consistency of one "Gineral C.," of whom James Russell Lowell wrote:

> Gineral C. is a dreffle smart man;
> He's ben on all sides that gives place or pelf;
> But consistency still was a part of his plan,
> He's ben true to *one* party, an' thet is himself.

Notice to Terminate a Contract of Service.

Employers and employed are constantly troubled with the question—What notice must be given in order to terminate a contract of service? Sometimes, of course, the matter is set at rest by the agreement between the parties; but it more frequently happens that such a calamity as a dismissal is not contemplated when the service commences. A case in the City of London Court, of which we published a report last week, shows the uncertainty there is on the subject. A man had been employed in March, 1912, as a traveller in electric supplies. He was to be paid 35s. a week, with 7s. 6d. for daily expenses, and third-class railway fares, and to receive a commission of 1¼ per cent. on business done. He was dismissed on a week's notice in May. He now claimed damages for wrongful dismissal, asserting a right to three months' notice, and saying that there was a custom in the electrical trade to this effect. The jury were unable to agree as to the custom, but expressed the view that the plaintiff should have six weeks' notice. It may be mentioned that if a litigant places reliance on a custom, he must be prepared to show that such a custom is universally known and recognised. For instance, a domestic servant is entitled by custom to a month's notice. We confess, however, that

we have never heard of any custom which prescribes that a traveller in fittings is entitled to three months' notice. From the point of view of an employer who might be saddled with a man who was altogether inefficient, such a custom would be irksome in the extreme, and he would, doubtless, take steps to guard against it in his written agreement.

New Zealand Contracts.

In a recent issue of the Electrical Review we referred to certain new conditions which were being formulated by the Australian Government for the regulation of the adjudication of tenders received for Government work and supplies. It will be remembered that the chief effect of these new conditions was to establish as a principle preference to British tenders, as against those of foreign firms. It is with considerable satisfaction that we now note that conditions which will have a similar effect are to be introduced in New Zealand. On another page (see p. 536) we publish a copy of a notice which the Board of Trade have issued in their *Journal*, and which will show exactly what steps it has been possible for their representative in New Zealand to take. It will be seen that the method by which preference to British tenderers is to be given in this case, is different from that adopted in Australia and, if possible, it is more definite. Under the New Zealand tariff higher duties are leviable on foreign goods than those on British if imported for ordinary purposes of trade. But as Government supplies are admitted free of duty, no matter whence they come, the principle of preference to British trade adopted by the Government has not had any effect up to the present on the importation of Government supplies. It has now been found possible to induce the New Zealand Government to prescribe that in all cases of tenders for Government supplies the amount of the difference between the lower duty on British goods and the higher duty on foreign, which would have been operative had any duty at all been levied, shall be added to every foreign tender before comparison is made between the British and foreign tenders for adjudication purposes.

It is perhaps hardly necessary to point out what a tremendous advantage this will prove to British trade, and as, by reason of the vast supplies of water-power available, the electrical development of New Zealand is destined to be very great in the near future, our electrical firms may look for a decided improvement in their position in this Dominion. The Government, as our columns have shown from time to time, are particularly interested in this development, and are making every endeavour to encourage it as much as possible. The Lake Coleridge scheme is an important beginning, and we hope that the greater part of this scheme at least will be carried out by British firms, although we suppose that the new principle of preference now referred to will not operate in this case.

Finally, we find the greatest possible pleasure in congratulating the Board of Trade on its recent successes. The new position in Australia, as we showed at the time, was almost entirely due to the activities of Mr. Hamilton Wickes, then the Board of Trade's representative in the Commonwealth, and now in New Zealand the changed conditions are apparently the result of the representations of Mr. W. C. Wickham, the Board of Trade Commissioner there. The principle of representation of British trade interests in our own Dominions is of comparatively recent origin, and it is gratifying to find that it has been so practically successful.

Patent Revoked.—The Comptroller-General of Patents announces that an order was made on September 28th, under Sec. 26 (3) of the Patents Act of 1907, revoking the letters patent granted to Ettore Bellini for an invention entitled "Improvements in or relating to transmitters and receivers for wireless telegraphic and telephonic apparatus," No. 11,339, of 1911.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

SPECIALIST in meters, instruments, and switchboard apparatus, design and manufacture; good organiser, requires leading position; prepared to take charge of department or works; excellent credentials. *At present in England.*

So runs an advertisement in a Canadian technical journal the italics being due to the present writer, and not to the advertiser.

There seems to be a popular idea at home that any Englishman will be snapped up at once as a great acquisition in Canada, and it will, perhaps, not be out of place here to state that *as a general rule*, it is taken for granted that men from the Old Country require educating up to Canadian standards before they can be trusted with work of any real importance, and there is certainly some truth in it, as a new man fresh from home has to learn a number of new terms and methods, and generally readjust his ideas about many things, so that there are very few firms over here who will give such a man a really responsible post at once, even if he be over here, and the futility of advertising for such while still in England, is therefore evident. The "specialist in meters, &c.," might very well have kept his money for some other purpose (*e.g.*, let it go towards his fare over here), for the chance of his getting a reply is remote, while that of his getting a "leading position" is still more so.

The truth of the foregoing remarks illustrating the difference between the Englishman's idea of what Canadians think of him, and what they actually do think of him, is well illustrated in the following, quoted from an address given recently by a prominent man, evidently himself a Canadian :—

"I will first take one historical illustration from that old land, spoken of sometimes by the buoyant and boisterous Canadian, without an accent of noticeable respect, as old, moss-covered, stick-in-the-rut England. I do not admire the harshness of some of the adjectives I have heard lusty, self-confident young Canadians use." Again, quoting from the same source: "In some respects, we, in Canada, are a self-satisfied people. Other people praise us so much that, to be agreeable, we join in the chorus and enjoy a reasonable measure of self-laudation. There is quite a different attitude of mind in England and in Germany and in Scotland."

These quotations sum up the situation extremely well.

While dealing with this subject, it may be well to go a little further.

The same reasons which prevent Canadians from placing too much responsibility on the shoulders of newcomers are those which should be taken into account by British firms sending representatives over here, for these representatives have to be given time, first of all, to fall into the ways of the country, and secondly, to get themselves known and get into that intimate touch with local affairs and sources of information which is so necessary to success in this line of work. Canadians can get hints and information from other Canadians which will not be given to the newly arrived Britisher. This fact is a very serious handicap to him, and principals at home should either be prepared to deal leniently with their representatives for 18 months or two years—the latter period is not too long—or they should not launch out in this way at all. Once launched out, they should at all events stick to their policy for at least the period named, when they may expect to reap the fruit of their patience. The market here is bound to increase for a long time more rapidly than the industries of the country, and there is no doubt that British goods are becoming better known and better appreciated. For any firm to send out a man and expect him to do wonders in the first 12 months is folly, and to abandon the policy of having a man here at the end of such a period because profits have not been rolling in is worse, because they will lose a lot of money, whereas by keeping on they would begin to see a steady improvement. Of course, this assumes a good man, goods of proper quality at a suitable price, and, not by any means the least important item, quick and certain delivery.

One prominent British firm which has been represented here now for some three years appears to be well on its feet, though the earlier portion of this period brought admittedly uphill work.

Reference was made in these Notes some time ago to an article in a Canadian technical journal on the breakage of water-wheels, which was said to be due to defective design; the same paper now reports the bursting of a turbine at the Shawinigan Falls Power Co.'s No. 1 Station. The station was flooded to a depth of 10 ft., one man was killed and nine others had narrow escapes.

A somewhat amusing position appears to have arisen between the Hydro-Electric Power Commission, of Ontario, and the owners of the Chats Falls on the Ottawa River. The owners claim $3,000,000, while the Commission, it is stated, will offer $2,000, the original purchase price; reference was made to this matter in the last "Notes." It will be interesting to see how the arbitrators (presumably this will be a case for arbitration) will "split the difference" in this instance.

The city of Calgary, Alberta, is going ahead as regards electric power; £40,000 is to be spent on electric light extensions—400 per month is said to be the rate at which new connections are being made.

Natural gas is now available in the city, and 2,000 H.P. of stand-by steam plant is to be operated by using this gas for firing the boilers. An official is to look into the question of using gas engines for future extensions, as the water-power available is practically all utilised now.

A French-Canadian company has asked the permission of the City Council of Montreal to construct underground electric tramways, and Parliamentary powers will be sought.

NOTES ON THE ECONOMICAL RUNNING OF LOW-PRESSURE TURBINES.

[COMMUNICATED.]

In most cases where low or mixed pressure turbines have been installed to take exhaust steam from existing engines, a very great saving has been effected.

The saving is greater of course when engines have been running non-condensing, but even where the turbine is installed to take steam from engines which were running condensing, a saving of from 25 to 35 per cent. (depending on the efficiency of the engines and the vacuum obtainable in the turbine condenser) is usual.

The writer has found that users (although well pleased with the results obtained) are not always getting the highest possible efficiency from these plants. Low-pressure turbines are usually designed to run with steam at a pressure of 16 lb. absolute. Should the amount of steam delivered from the engines be too great for the load on the turbine, there are two alternative methods of getting rid of the surplus.

1st. By allowing the surplus steam to pass to atmosphere through an automatic valve, and

2nd. By by-passing the surplus steam to the turbine condenser.

When the turbine is supplied with steam from an engine with a steady mechanical load (such as a mill engine), the turbine is designed to keep a pressure of 16 lb. absolute in the engine exhaust pipe, when both turbine and engine are fully loaded.

When the turbine is installed in a generating station, however, both engine and turbine are connected electrically to the same bus-bars (either direct when both are generating A.C., or through a rotary converter when the engines are D.C. and the turbine A.C.).

As the load changes between the engine and the turbine, the pressure in the low-pressure steam pipe will vary in some cases as much as from 16 lb. absolute to 10 lb. absolute.

It is advisable, therefore, that a compound (pressure and vacuum) gauge should be fitted to the low-pressure steam pipe and in view of the switchboard attendant, so that he can regulate the load between the machines to give as nearly as possible 16 lb. pressure in the low-pressure steam range. The automatic valve should be set to open at 17 lb. absolute; if it is set below this, it will be found that steam escapes even when the steam pressure at the turbine is below that of the atmosphere.

This is due to the delivery of steam from the engines being intermittent—each puff lifts the valve. In some cases which have been brought to the writer's notice, the pressure of the exhaust steam is allowed to fall for considerable periods to 10 or 11 lb. absolute. This represents a loss of about 6 per cent. There is, however, a further saving effected by keeping the pressure in the low-pressure steam pipe above atmospheric pressure.

In most cases where turbines are connected to existing engines there is a large amount of leakage at pipe joints, engine low-pressure glands, &c. These leakages were of no great importance when the engines were exhausting to condensers, as a vacuum of 25 or 26 in. would be obtained. With the turbine, however, a high vacuum is indispensable for economical running.

By keeping the pressure in the low-pressure steam pipe and low-pressure cylinders of the engines above atmospheric pressure no air will be able to enter, and a high vacuum will be possible in the turbine condenser.

In one case within the writer's experience, in which four compound engines exhaust to a low-pressure turbine, a 28½ in. vacuum was obtained when the low-pressure range was sealed by keeping the pressure above that of the atmosphere. When the pressure in the range was allowed to fall 4 lb., the vacuum in the turbine condenser fell to 27½ in., representing a loss in efficiency of 10 per cent. There is, of course, a slight decrease in the efficiency of the engines when the back pressure is increased, but this is very slight compared with the saving effected on the turbine.

The writer has found in practice a saving of 9 per cent. on the overall (engines and turbines combined) consumption, by running with a pressure of 16 lb. absolute in the low-pressure range, instead of 13½ lb.

International Electrotechnical Commission.—We have received from the general secretary, Mr. C. le Maistre, a copy of the Third Annual Report of the Electrotechnical Commission, which contains a brief summary of the history of the Commission and of its proceedings to date. It will be remembered that at the Turin meeting held in September, 1911, a certain number of special International Committees were instituted to carry on the work in its preliminary stages and to draw up proposals for submission to the various local committees, of which there is one in each of 20 different countries. Meetings of these small International Committees have been held in Cologne and Paris, and the work accomplished at those meetings is now being considered in the different countries.

A meeting of the small International Committee on Symbols and on the Rating of Electrical Machinery will probably be held at the beginning of December next, when the observations and criticisms upon the present proposals will be taken into consideration.

In this country the proposals of the Special Committee on the Rating of Electrical Machinery are being considered by the Joint Committee of the Engineering Standards Committee and the British Electrotechnical Committee. On this Joint Committee both users and manufacturers are represented, so that the industry may rest assured that the detailed propositions of the small International Committee will be very carefully scrutinised.

A new development, which also owes its inception to the Turin meeting, has recently taken place in the appointment, by the President of the I.E.C. (Dr. E. Budde) of a Special Committee on Prime Movers in connection with electrical plant. This Special Committee is the outcome of a report presented at Turin by the Italian Committee. Italy, having no coal, has been forced to turn its attention most seriously to the question of water power, and the Italians feel that the time has arrived when the terms used in this connection, which are so intimately connected with the electrical side of the problem, may usefully receive the attention of the I.E.C.

The appointments on this Committee, which will consist of some eight or 10 members, will be made directly after the Summer Vacation; one or two have, however, already been made, the most important of which is that of Mr. H. Zoelly, of Messrs. Escher, Wyss & Co., of Zurich. The Commission is to be congratulated upon securing the collaboration of a man of such wide experience.

It will thus be seen that the four Special International Committees (on Nomenclature, on Symbols, on the Rating of Electrical Machinery, and on Prime Movers in connection with Electrical Plant) are carrying out a most useful, and, indeed, essential *rôle* by covering the ground work in such detail, and thus paving the way to international agreement upon well-defined lines. Their labours will have the important result of lightening the work of the next plenary meeting of the I.E.C., which will be held in Berlin in 1913.

THE MUNICIPAL TRAMWAYS CONFERENCE.

(*Concluded from page* 504.)

In our last issue we briefly referred to Councillor Neumann's paper on "Tramway Administration by Municipalities: A Retrospect and a Forecast," one of the main objects of which, as stated, was to discuss whether municipal ownership of street transit has proved a blessing to the community and an advantage over private ownership. That he considers municipal ownership is generally admitted to be justified, is only natural, but he is not unreservedly in favour of all municipal methods.

He admits, for instance, the drawbacks of tramway control by a self-selected municipal committee, pointing out that "to make this even moderately successful, it is essential that the best intellect and ability in the country should be pressed into service."

But the business man generally has his hands full, and political or popular candidates who do attain to municipal honours are obviously a very poor substitute. Councillor Neumann, however, says: "In face of the enormous amount of capital invested in, and the large number of people dependent upon, municipal commercial undertakings, is it not absolutely necessary that they should be controlled by those who are best qualified for the work through their business experience and administrative ability? How this ideal can be achieved may well be left to discussion. It would, indeed, be an anomaly if tramway committees were thus improved in their constitution, that the carefully considered decisions of a practical body of men should still be liable to adverse review by a less well-informed, but numerically stronger body in the shape of the Council. It seems to follow, therefore, that tramway committees would have to be invested with a limited power of self-government, and not subject, to the same extent as now, to the caprice of a higher authority. These may be reforms difficult of accomplishment, but they will probably become necessary if municipal trading is to hold its own against shrewd, keen and businesslike competitors." We entirely agree.

Moreover, the squeezable committee, unable to dissociate philanthropy from business (and one might add, unable to resist municipal pioneering in undeveloped districts), is a continual source of danger in tramway administration, and this applies almost as much to the autocrats in charge of local exchequers, who attack surpluses, as Mr. Neumann says, "more often than not without the consent of . . . . or even consulting the manager or committee concerned."

Whether he intended it or not, Councillor Neumann reveals many chinks in the municipal armour, and as his remarks come from within, we trust that his brother Councillors will profit thereby to the ultimate great benefit of municipal tramway administration generally.

Glancing back over the discussion which followed, one is struck by the unnecessary anxiety which London 'bus developments seem to have aroused even in the provinces. Granted that the London tramway has its "little affair," this is due primarily to the peculiar conditions existing in London, which have no counterpart in the provinces.

In the discussion, Mr. Alfred Baker (Birmingham) asked for authentic figures for 'bus operation, commenting strongly on the partiality of certain London papers for the motor-'bus, and on their misleading and utterly fallacious statements and deductions.

Ald. Fred. Smith (Liverpool) felt that the 'bus was quite entitled to use the roads, but that the tramways were unfairly burdened in regard to the latter. Figures of costs in regard to the 'bus were wanted, and at Liverpool they would shortly obtain them from their own 'buses. He considered that competition would lead to increased tramway efficiency, and prevent the present tendency to grant undue concessions.

Mr. W. A. Luntley (Wolverhampton) came to the rescue with some particulars as to the cost of running two or three 'buses in his town, which, on the basis of seven months' operation, and allowing 25 per cent. for depreciation, cost 7½d. per car-mile, but he expected that the figure would increase to 8d. for the year.

Mr. Stephen Sellon urged that 'bus competition should be taken seriously; he considered that the 'bus should contribute to the upkeep of the road, whatever might have been argued as to the effect of railless trolley vehicles. The company director left much more to his manager than the councillor did, and that was where municipal administration was at fault.

Alderman Gee (Huddersfield) made a suggestion that tramway committees might be given similar powers to watch committees, which could not be upset by the Council, and Alderman Brown (Leeds) wound up the discussion with a contribution which disclosed many weak points in municipal government.

No figures were advanced in regard to the London 'buses, although we have heard that the modern vehicles cost no more than 6¾d. per mile to run, inclusive of all charges—a low figure which appears to be explained by the fact that the company builds its own rolling stock on a wholesale scale, and, it is said, at a cost of not more than £350 per vehicle.

A paper by Mr. W. J. McCombe (Hull) on "Tramway Fares and their Basis," dealt with this very controversial matter in the abstract. He arrives at an early conclusion that no municipal tramway is in practice worked on strictly commercial principles, and that there is no systematised and recognised arrangement of tramway fares by municipalities. In fact the fare schedule, according to Mr. McCombe, is the result of compromise between sections of the committee who view the subject from widely varying standpoints.

He urges that it is futile to take for granted that fares, either general or particular, are a fixed quantity, or of settled quality, without reference to effluxion of time, change of environment or improvement in general conditions. After carefully dissecting the well-known formula that the 1d. fare is the backbone of tramway finance, he comes to the conclusion that there are indications in favour of a lower popular fare, namely, the ½d. fare, for short distances. But, as in the case of most of his arguments, he points out that only favourable local circumstances would justify its adoption. He says it has been proved over and over again that paper speculations are of little value in order that fares may be settled upon an equitable basis, and recommends a practical experiment as the best method of settling the question.

In conclusion, Mr. McCombe considers that philanthropic, patriotic and charitable concessions, and special privileges in other directions are a mistake, and quite undesirable in the case of the democratic tramcar. Tables are given showing the average fares charged per mile for the provincial tramways—the accuracy of which, it is almost unnecessary to add, was speedily challenged by several of those concerned.

The following were the principal points in the discussion:—

Mr. F. Schofield (Leyton) twitted the author as to the abstract nature of his remarks; there was nothing definite. He (the speaker) thought that a more equitable method of comparison would be on the basis of percentages of fares values. At Leyton, inclusive of the original purchase price of the old system, the tramways with 9 miles of route cost about £300,000, and it was misleading to compare such a system with one where capital cost was small. He had changed his opinion in regard to the ½d. fare; density of population might justify its adoption. The dominating influence in London was the motor-'bus, and he admitted its superior mobility on the roads, but thought the tramway could compete satisfactorily in his area by a rearrangement of fares.

Mr. J. Dalrymple (Glasgow) said the burden of the paper was the giving of the longest possible ride for the lowest paying fare, also that it was a mistake to consider the 1d. fare as necessarily the mainstay of tramway operation. At one time he would have strongly disagreed with the latter argument, but he confessed that his opinion had been forcibly changed by experience during the last year or two. At Glasgow the ½d. fare distance had recently been extended from a little over ½ mile to over a mile in length, and he had fought against the change, believing that they were carrying all who wanted to ride, but as it turned out the change had resulted in their obtaining an extra million passengers a week. These entailed extra expenditure, but only few extra cars, as a very large proportion travelled during slack hours, when there was plenty of accommodation available. The change resulted in an increase of from 10½ passengers per car-mile, to 13 passengers per car-mile, and as the new traffic was collected in the inner zone, the problem in future was how to cater for this enormous traffic. It resulted in 50 million additional passengers per annum, and required an extra 30 cars; the expenses were not so much greater, and he believed that in time the additional fares would make up for the loss of revenue through increasing the stage length.

Mr. C. J. Spencer (Bradford) urged the members not to apply the results at Glasgow too generally. In his town they had had a universal 1d. fare before 8 a.m., but this was followed by making all 1d. fares into ½d. fares before 9 a.m. He found at first that the receipts fell *pro rata*, then extra travellers appeared, and now they had to run many extra car-miles to accommodate the traffic, and these were all run at a loss before 9 a.m., resulting in a net loss in receipts. The conditions were quite different from those prevailing in Glasgow.

Mr. J. M. McElroy (Manchester) argued that it was dangerous to suggest the possibility of introducing ½d. fares generally, and he noticed that the author had said nothing in his paper as to their effect on his own (Hull) undertaking. In looking into the condi-

tions there, he found that Hull had about the highest population and revenue per track-mile in the country, thus favouring the low fare. They carried the passenger 2¾ miles for a 1d., and before 9 a.m. all 1d. stages were charged for at ½d. In 1908 the Hull undertaking earned 10·22d. per car-mile, but since the introduction of ½d. fares the annual averages had fallen to 9d., 8·9d. and 9·65d., and he considered that the passengers after 9 a.m. were paying for those before that hour. Fares which were good enough for part of the day should be good enough for all day; but if at Hull the ½d. fare were available all through the day, it appeared that it would result in the gross profit being entirely wiped out.

Councillor Heather (Leyton) said the real basis of fares was environment, and in London the 'bus competition was the determining factor. Ald. Brodie (Blackpool) enlarged on the excellencies of the Blackpool system, explaining the simple procedure adopted in his town to overcome 'bus competition. There, with the advent of the tramway car, the Watch Committee refused to license the competing omnibus.

Mr. J. B. Hamilton (Leeds) expressed the view that low fares attracted passengers, and providing the ½d. fare proved a source of revenue, as in Leeds, there was no reason why it should not be adopted. In view of the large surpluses earned in some undertakings, it was a question whether the fares should be lowered, and he thought they should. Where the tramway provided adequate facilities the 'bus should not be allowed.

Rail Corrugation.

On Wednesday afternoon, September 25th, a short discussion took place on the interim report of the Special Committee appointed to inquire into the phenomena of corrugation on tramway rails. This report, which is of a very interesting character, and illustrated with numerous explanatory diagrams and half-tones, can be obtained from the Secretary of the M.T.A.

A Committee was originally appointed to deal with the matter in 1908, and in 1909 it was arranged to co-operate with the Tramways and Light Railways Association, certain members of the latter joining the Committee; Mr. C. A. King, of London, was also appointed advisory engineer, and with a Committee of four carried on the investigations. Inquiry was directed to find whether corrugation—

1. Exists initially in the rail itself.
2. Exists initially in the tire.
3. Is produced by the mutual action of wheel and rail, which action must be one of, or a combination of, the following:—

(*a*) By the ordinary rolling motion of the wheels owing to the rail not being hard enough to withstand the local rolling action.
(*b*) By the wheels slipping.
(*c*) By the wheels skidding.
(*d*) By the radial slipping of wheels and axle.

They issued a list of queries to members of the Association and classified some 6,000 replies which are summarised in the report; they also arranged for experimental work which was carried out at Bradford, Dundee, Glasgow, London, Leeds, Manchester and Sheffield, and is also duly recorded in the report.

The replies show that generally systems most free from corrugation are more hilly than the average, and that climatic conditions have no particular effect. Apparently, neither class of paving, make of rail, method of laying nor anchoring, has any direct bearing on the matter; this also applies to the number of cars using the rail before the appearance of corrugation. On 85 per cent. of the systems the wave length of the corrugation is between 2 and 3 in., the extremes are 1½ in. and 7½ in.; and it is quite frequently found where coasting is habitual.

An interesting section deals with the occurrence and characteristics of corrugation, showing that it occurs on both cast and rolled permanent way material, and is produced by both bogie and single-truck cars. It has been found on cable tramway tracks at Handsworth, Streatham and Douglas, and on many railways, but was not known on horse and steam tramways.

An interesting case of the alternate production (by Erith cars), and removal (by Bexley cars) of corrugation on a tramway at Northumberland Heath (Bexley Heath Tramways) is cited, the route being operated by agreement for alternate periods by the two concerns.

It is pointed out that the two types of cars are very similar, and braking arrangements the same, except that the Erith cars have magnetic track brakes, and the Bexley cars have no track brakes.

The Bexley cars, however, ride more easily owing to improved springing and have chilled wheels, while the Erith cars have steel-tired wheels.

An interesting sequel to the foregoing was the statement at the meeting that since the report was prepared, corrugation had appeared on the Bexley tramways.

The Committee made the following general observations:—

There were indications of corrugation in every possible position, viz., on up and down gradients, on straight and curved track, on one or on both rails, or on either rail separately, alternately, and also intermittently.

Periodical records of corrugations at the same places did not indicate any tendency of the ridges to creep along the rail, although the markings appeared to vary in intensity, and to merge from the defined ridge type to the patch type, and *vice versâ*.

The patch type appeared to exist in conjunction with speeds over 12 miles per hour.

Acid tests demonstrate that the corrugation effect is practically superficial, and that the metal in the hollows is less dense than at the crests. Consideration as to the cause of the hollows leads to the conclusion that cold flowing of the rail material does take place, and if this were combined with a certain amount of attrition, the result would probably be in accordance with the actual state of the rail structure as demonstrated by tests.

The information collected by the Committee (by experiments and otherwise) amply showed that slip and skid are continually taking place, and that a pure rolling motion very seldom takes place even for one complete revolution of the wheel.

The general information placed before the Committee coupled with the striated appearance of the corrugated rails, suggests that corrugation might be created by the alternating slip or skid and rolling action of the wheel during its passage along the rail. Slipping or skidding, possibly in conjunction with rotation, would appear to take place in the hollows and pure roll coupled with increased pressure at the crests.

The Committee do not agree with the theory that cold rolling alone is the cause of corrugation, and describe experiments made with saw cuts in rail heads and artificially produced markings in paint, sand, &c., in support of their contention.

As the result of their investigation, the Committee arrive at certain interim findings, based on the foregoing and including the following:—

Corrugation occurs . . . . with electrically self-propelled rolling stock, the construction of which necessitates a relatively low centre of gravity. . . . It is not necessary that the track or the rolling stock or the wheel profiles should be in a worn or defective condition. . . . .

Corrugation appears on the rails independently of whether the wheels are being actively driven from the motors or not. [It is suggested that slip and skid take place owing to different wheel diameters due to unequal wear produced by differences in motor speeds.]

Corrugation may be caused and removed by the same set of cars under apparently the same conditions; it does not exist on tramway rails as received from the rolling mills.

As a suggested measure for mitigation of the trouble, it is proposed that a better steel for rails should be obtained, and particulars are given of the physical tests recommended.

Particulars of further experiments, and information required, are mentioned, and an appendix contains a list of previous papers and reports bearing on corrugation matters.

In the discussion Mr. J. M. McElroy (Manchester) said he was satisfied that the report (of which he gave an abstract on the lines of the foregoing) carried the matter a long way towards solution. In places like Glasgow and Manchester, corrugation cost them as much as £10,000 per annum. In his view micro-photography would help largely towards the solution of the problem and the production of a suitable steel for rails.

Mr. C. J. Spencer (Bradford) read a short report from Mr. King, who was unable to be present, and in which he assumed that the origin of corrugation was a condition or set of conditions which exists clearly with electrically-driven rolling stock. Among the features necessary were pronounced inequality of wheel diameters; side thrust of flanges due to low centre of gravity; holding down of wheels on to hard unyielding track, &c. It was curious that there was no corrugation and very little wear on three London tubes, but in this case the track was very elastic, and the rail yielded about

¼ in. vertically to the passage of wheels, and also laterally, thus reducing wear.

Prof. Carus Wilson considered that it would not be possible to get to the root of the matter until they could produce corrugation to order. Corrugation had been produced on purpose, experimentally on several systems, but could not be repeated when wanted. The Erith case was particularly interesting; it was the hollow of the corrugation that required investigation.

Mr. Stephen Sellon said there ought to be a representative of the rail manufacturers on the committee; the manufacturer knew that he was not supplying the best rail for present day use, and the rail composition and modern methods of rolling accounted for the presence of corrugation.

Mr. W. J. Hadfield (Sheffield) pointed out that the rolling mill practice was that approved by Mr. Sellon; and Mr. Holt (Leeds) said manufacturers did not know how to supply the class of rail demanded.

Mr. R. C. Bullough (Colchester) thought the rolling mill was the root of the trouble, instancing the fact that one rail only in a batch was sometimes corrugated; and Councillor Knowles (Sheffield) advocated the presence of both rail maker and metallurgist on the committee.

On Thursday, at the conclusion of the discussion on Mr. McCombe's paper, the delegates and visitors were again entertained at luncheon by the West Ham Corporation, and in the afternoon adjourned to the Exhibition at the Plaistow depôt, many of them proceeding later to a Garden Party at West Ham Park, where musical entertainment was provided by the West Ham School Choirs and the Tramways Band.

In the evening, the annual dinner of the Association was held at the Liverpool Street Hotel, when some 400 of the members and their guests were received by the President and Mrs. Blain.

Mr. A. R. Fearnley (vice-president of the M.T.A.), proposed the toast of "The Mayor and Corporation of West Ham," the Mayor (Alderman Hurry) suitably responding; it fell to Councillor Rodgers (Newcastle-on-Tyne) to propose "The Guests"—who were numerous—while the toast of "The Municipal Tramways Association," suffered nothing at the hands of the Hon. Arthur Stanley, M.P.

The annual business meeting of the Association was held on Friday morning, when Mr. A. R. Fearnley (Sheffield) was elected president for the coming year, and the Mayor of Salford (Alderman Linsley) was appointed vice-president, Mr. C. J. Spencer (Bradford) being re-elected hon. secretary. It was decided to refer the question of action in regard to 'bus competition to the Executive Committee, with power to act; the Committee was also empowered to express the views of the Association upon the alterations made to the Light Railways Bill.

ELECTRICAL INSTALLATION AT THE WESLEYAN METHODIST HALL.

The new Methodist Church House and Connexional Offices at Westminster, the formal opening of which took place yesterday, have been erected by trustees with Sir Robert W. Perks, Bart., as treasurer, from part of the Twentieth Century Million Guineas Fund. This striking block of buildings stands on part of the site formerly occupied by the Westminster Aquarium and the Imperial Theatre, and is to the designs and plans of Messrs. Lanchester and Rickards, the architects. Our readers will be interested here more particularly in the engineering equipment and the electrical plant and installation, running into a matter of some £5,500. Mr. T. Kerr-Jones, A.M.I.E.E., of Victoria Street, S.W., was instructed by the architects to prepare specifications and plans for the installations for power and lighting, and he was, after the contracts were let, commissioned by the trustees to superintend the work during its execution.

For power work, electric driving has been adopted throughout the buildings, there being 14 motors, with a total of about 120 H.P. The motors are supplied with continuous current at 400 volts from the mains of the Westminster Electric Supply Corporation, Ltd.

The applications of the motors are sufficiently diverse to give a good example—if one be needed—of the adaptability of the electric motor to all classes of work: these comprise the operation of three kinds of pumps, blowers and extractors for the air purifying and heating system, also passenger lifts, organ blowers, sewage ejector plant, and a battery booster.

Commencing with the pumping plants, it may be mentioned that the whole of the water supply for the buildings is drawn from a 450-ft. well, from which it is raised pneumatically to groups of tanks, most of which are placed well above the highest level of the office block. Pumping from the well is carried out by two vertical air compressors, each driven by belt and gearing from a 15-H.P. motor.

In the room which contains these compressors is also installed a fire service pump. This is of the multiple stage centrifugal type, running at 1,870 R.P.M., and direct coupled to a 12-H.P. motor. Its purpose is to keep charged a tank, situated almost at the very apex of the dome and nearly 200 ft. above street level, by means of which the proper head is maintained on the fire hydrants. From this tank a pressure pipe is taken to a diaphragm pressure relay fitted at the base of the dome. This relay has a metal pointer which moves to the left or right according to whether the head in the tank is below or above normal. If water be drawn from the hydrant the pointer makes contact with an adjustable stud, and so closes a circuit causing the pump to start. When full pressure is again restored the pointer moves away from the stud, and, travelling in the opposite direction, reaches another stud upon which a second circuit is closed and the motor stopped. This relay is connected by three wires running to the basement with the automatic solenoid-operated starter which controls the pump motor. It must, of course, be understood that the tank in the dome is only a pressure tank; the pump will draw from a storage tank of about 5,000 gallons capacity in the basement. The pumps were installed by Messrs. Arnold Goodwin & Son.

For pumping the condensed steam from the radiator heating system, two vacuum pumps have been installed by Messrs. Ashwell & Nesbit, and these are driven by belt from a 5-H.P. variable speed motor, running at from 760 to 1,000 R.P.M.

In connection with the "Plenum" heating and ventilating system, also installed by Messrs. Ashwell & Nesbit, there are two blowers and one extractor fan. Each of these is driven by belt from a 12-H.P. motor, running at from 770 to 1,000 R.P.M.

In the office block are installed two lifts, erected by Messrs. Wm. Wadsworth & Son. These have solenoid-operated starting and reversing control gear operated by a master switch in the cab and by limit switches, top and bottom. Each lift is driven by means of worm gearing from a 12-H.P. motor, running at 950 R.P.M.

The fine organ, by Messrs. Wm. Hill & Son, receives its wind from two blowers, one of which adds its pressure to the wind furnished by the other, so that both high and low pressure can be obtained. These blowers are both of the "Discus" type, driven by belts from a 5½-H.P. motor, running at 840 R.P.M., and controlled by a solenoid-operated starter, worked from an ordinary tumbler switch near the organist's seat, this latter control circuit being at 200 volts. A similar set of apparatus will be installed for the second organ.

As is well known, the sewers in the Westminster area are very near the surface of the streets, and to raise the sewage from the sub-basement into the drain a duplicate set of "Shone" ejector apparatus has been installed by Messrs. Hughes & Lancaster. The electrical portion of this plant comprises two 1½-H.P. air compressor motors, which are controlled automatically. The air reservoir has pipes leading to diapraghm-pressure relays, which start and stop the motors in accordance with low or high pressure, in an analogous manner to the fire service relays mentioned above.

The motor driving the booster is 7 H.P., and runs at a speed of 900 R.P.M., driving it direct through a flexible coupling. The booster set is of Electric Construction Co.'s make.

The lighting of the buildings comprises about 1,600 lamps, and there are five entirely separate lighting installations—viz., the Office Block, the London, City and Midland Bank, the Public Positive, Public Negative and "Police" circuits.

The supply for lighting is at 200 volts throughout, the

lamps in the office and public installations being divided approximately equally between the positive and negative sides of the 400-volt three-wire service of the Westminster Electric Supply Corporation, Ltd.

To meet the regulations of the London County Council, it was originally intended to take the supply for the "Police" circuit from the mains of the London Electric Supply Corporation. After the wiring had all been run on this basis, the result of the litigation between the two supply companies was that the Westminster Co. assumed the management of the London Corporation's system in the Westminster area, and that they were not willing to give a supply from the London Co.'s mains. Under these circumstances a battery was installed to meet the demand for an entirely separate source of supply to feed a certain proportion of lamps in all portions of the buildings accessible to the general public; this battery consists of 108 Type L-11 cells of the D.P. Battery Co.'s make, and is charged during the daytime from the Westminster Co.'s 200-volt supply through a booster giving 45 amperes at 0 to 92 volts. It is capable of maintaining the whole of the lamps on the "Police" circuit for six hours on one discharge.

There are two main control rooms, one in the basement and one adjacent to the great hall, and the greater part of the main distribution and distribution boards are grouped in these control rooms, from which about 40 separate circuits radiate. The sub-distribution boards are placed in accessible positions in different parts of the buildings. About 30 miles of cables and wires and 10 miles of conduit have been fixed.

The materials throughout are to a very high standard. All cables and wires, both for lighting and power, are of C.M.A. 2,500-megohm grade and of Connolly's make, whilst all conduit is of heavy-gauge solid-drawn steel, heavily galvanised inside and out. The whole installation is on the draw-through system, and the large number of boxes installed will facilitate inspections and repairs. All distributing boards are in heavy cast-iron cases, a few being fitted with oak frames on cast-iron shells, and where in view the cases are recessed into the walls.

The fittings in the main halls, reception rooms, conference halls and library, are of striking design, and carried out in real bronze with satin-finish glassware. They were specially designed by the architects, and supplied partly by Messrs. J. W. Singer & Sons, and partly by Messrs. Strode & Co.

A great number of the fittings are in the form of two-light and three-light brackets, and these are all fitted with Strode bracket boxes and connecting sockets, so that a bracket may be bodily removed for cleaning without having to unfasten or disconnect the fitting. The main electroliers are provided with iron disconnecting boxes with porcelain connector fittings, and are lowered for cleaning by means of permanent winches.

Messrs. Dove Bros., Ltd., were the main contractors for the whole of the building, and the whole of the wiring for power and lighting was carried out by Messrs. Strode & Co., who also installed the battery and its apparatus, the water level alarm indicators and the intercommunication telephone system.

The clerk of works was Mr. E. C. Howell, and Mr. C. Hale, who was Messrs. Strode & Co.'s foreman during the execution of the contracts, has been appointed electrician-in-charge.

Theatre Installations.—Messrs. S. Gillitt & Co., of Newcastle-upon-Tyne, are at present engaged in carrying out the electrical installations at the following theatres, &c.: Hippodrome, Newcastle; Royal Theatre, Hebburn-on-Tyne; Theatre Royal, Sunderland; Empire Palace, Easington Colliery; Victoria Theatre, Southbank; Prudhoe Picture Palace, Prudhoe-on-Tyne; Palace Theatre, High Shields, and Summerhill Palace Theatre, Birmingham.

Japanese Failure.—According to a Reuter dispatch from Tokio, it is reported from Osaka that, "as a result of the recent forgeries by the cashier of the Nagoya branch of the Mitsui Bussan Kaisha, who fled after putting into circulation bills in the name of the firm for 700,000 yen, the majority of which were held by local banks in Nagoya and Osaka, the Saiga Electrical Co. has failed. The liabilities amount to 7,000,000 yen."

ELECTRICAL TRADE COMPETITION IN AUSTRALIA.

The report of the British Trade Commissioner for Australia for 1911 draws attention to the fact that during the year foreign firms, particularly American, devoted increased consideration to Australia by sending over special representatives to organise their agency arrangements in the various States, and by improving their selling organisation in other ways. This has been noticeable particularly in the trade in petrol and electric motors and lorries, telephone instruments and material, electrical machinery and material, mining drills, &c. The value of the total imports of electrical machinery in 1910 was £321,327, in which the United Kingdom participated to the extent of £176,119, or 54·8 per cent., the United States £93,036, and Germany £32,539. The following table shows the course of foreign competition in 1910—the figures for 1911 are apparently not yet available—in the several items which permit of classification:—

	United Kingdom.	United States.	Germany.	Other countries.	Total imports.
	£	£	£	£	£
1. Dynamo-electric machines over 200 H.P., and parts ...	22,273	2,994	630	14	25,911
2. Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof...	129,440	73,447	22,717	17,064	242,668
3. Regulating, starting and controlling apparatus, including distributing boards and switchboards, except telephone switchboards ...	19,192	16,595	2,512	2,555	40,854
4. Generators for direct coupling to steam turbines	5,214	—	6,680	—	11,894
Total	£176,119	93,036	32,539	19,539	321,327

It appears that when the question of the amendment of certain headings of the tariffs was under consideration in 1911, it was found possible to obtain preferential treatment for British goods under the headings of "Dynamo-electric machines over 200 H.P. and parts" and "Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof." The duties on these goods from the United Kingdom now are 12½ per cent. and 20 per cent. *ad valorem*, as compared with 17½ per cent. and 25 per cent. respectively on foreign goods. The report also enumerates in detail other imports of electrical materials in 1910 of the separate value of £682,217. The particulars are as undernoted, the respective figures for 1911 apparently being also not yet ascertainable:—

	United Kingdom.	Germany.	United States.	Other countries.	Total imports.
	£	£	£	£	£
1. Electroliers, gasoliers, chandeliers, pendants, brackets and zinc tubing	25,796	1,902	714	29	28,621
2. Electric fitting and appliances, namely, switches, fuses and lightning arresters	19,672	6,434	5,878	2,952	34,936
3. Electric heating and cooking appliances	1,589	175	535	48	2,347
4. Electrical and gas appliances (not included elsewhere) ...	79,094	42,545	19,143	12,734	153,516
5. Accumulators, arc lamps and carbons, cable and wire (covered) carbon in blocks of 12 sq. in. and over, vacuum tubes, measuring and recording instruments and prepared insulating tape	277,105	61,447	9,643	9,437	357,632
6. Telephones and telephone switchboards and appliances	45,974	5,137	3,200	1,048	105,165*
Total	£449,410	117,640	39,113	26,248	682,217

* Includes Belgium £9,557, and Sweden £40,249.

The British share of the above formed 65·83 per cent. of the total, whilst Germany participated to the extent of 17·2 per cent., and the United States to the amount of 5·7 per cent. The bulk of the American trade is with New South Wales, and in some articles German trade is chiefly with Western Australia, a fact which is attributed to a strong distributing organisation in that State. Although British goods as a rule are more expensive, the report states that they are better made and more reliable than those from either the Continent of Europe or the United States, both of which rely for the sale of their goods rather on their low price than on their quality. In some lines British firms are ably represented and are fighting hard to hold the trade.

South African Lighting Association, Ltd.—The directors have declared an interim dividend of 3½ per cent., or 7 per cent. per annum, as compared with an interim dividend of 3 per cent. last year.

THE BRITISH ASSOCIATION.—V.

The Hysteresis Loss in Iron due to a Combined Pulsating and Rotating Magnetic Field.

By T. F. Wall, D.Sc., M.Eng., A.M.Inst.C.E.

While data are available relating to the hysteresis loss in iron due to pulsating and rotating magnetic fields acting separately, no experiments have been made to determine the loss due to their simultaneous action. In the case of a plain series single-phase commutator motor, the iron of the cores is subjected to the pulsating field due to a current in the stator winding, while at the same time the rotor core is rotating. Experiments were made by the author to determine whether the total hysteresis loss was the sum of the losses due to each cause acting alone. The hysteresis due to pulsation is similar to that produced in transformers and can be calculated in the same way. The hysteresis due to rotation is similar to that in a direct current armature, giving rise to a definite torque for each value of the flux, the hysteresis torque in the case of the A.C. rotor subjected to a pulsating field being the mean value of the hysteresis torque curve corresponding to the wave form of the pulsating flux.

The method of investigation adopted was to take "running-down" curves with various D.C. values in the stator windings of the machine used for the test, and also with A.C. in the stator windings. In the latter case, the pulsation hysteresis is supplied from the mains, and the rotor is retarded only by the rotation hysteresis. The D.C. tests enable the rotation hysteresis torque curve to be determined, and the A.C. tests show to what extent the rotation hysteresis is modified by the pulsation of the flux.

It was necessary to use special means for accurately measuring the falling speed, and a stroboscopic method was adopted. As the friction of the ball-bearings slightly diminished at low speeds if the bearings were cold, and the measurements had to be very accurate, the machine was run for several hours before taking a curve.

As the result of his experiments the author finds that :—

The rotation hysteresis torque is very considerably reduced by the pulsating action of the flux for those values of the frequency which are usually met with in practice (20-25 cycles per second). The reduction is about 58 per cent. for the range of flux densities used. The rotation hysteresis is, within wide limits of frequency of pulsation, constant, and for all practical values of the frequency may be considered to be the same for any frequency.

As the hysteresis frequency becomes reduced to very low values, the rotation hysteresis approaches in magnitude the value deduced from a curve connecting the rotation hysteresis torque and direct current in the stator winding.

The explanation of the reduction observed appears to be that the molecules of the iron being set in a state of rapid movement by one cause, the additional movement of the molecules corresponding to the other cause takes place much more readily than if either cause were acting alone.

Experiments for Improving the Construction of Practical Standards for Electrical Measurements.

Report of the Committee; Lord Rayleigh (*Chairman*); Dr. R. T. Glazebrook (*Secretary*).

(*Section A. Abstract.*)

The Reports from 1861 to 1911 inclusive have now passed through the press, and it is intended that this, the 1912 and final Report of the Committee, shall conclude the reprints, which will be on sale in the autumn of the present year. It seems desirable, however, that the Committee should remain in existence until all questions connected with the republication are determined, and, accordingly, they ask for re-appointment.

With regard to absolute measurements we have, as the direct result of the work of members of the Committee, two pieces of apparatus which should prove equal to any demand for precise measurements in the absolute system for very many years.

A report on the British Association Ayrton-Jones current balance appeared in 1908, and it was stated at that time that the probable error associated with a determination of current in absolute measure was about two parts in 100,000. Since then the balance has been used on several occasions; it continues to give satisfaction, and there appears to be no reason for doubt that so far as the absolute measurement of current is concerned an accuracy within at least five parts in 100,000 can still be guaranteed. This conclusion is greatly strengthened by the results which were communicated to the Association last year by Dr. Dorsey of the Bureau of Standards, Washington. At that Institution Drs. Rosa and Dorsey have made experiments with a new current balance, the coils of which are arranged in a manner similar to those used by Joule and by Lord Rayleigh. They obtained results for the electromotive force of the Weston normal cell which agree with those obtained at the National Physical Laboratory within four parts in 100,000. Whether this represents a real difference in the results given by the two balances, or is an actual difference in the E.M.F.'s of the reference cells used, has not yet been decided.

With regard to the absolute measurement of current elsewhere, a current weigher has been built at the Laboratoire Central d'Electricité, Paris, and at the Reichsanstalt further measurements are to be made in the near future. It will be seen, therefore, that the absolute measurement is on a very satisfactory basis. At the National Physical Laboratory no efforts will be spared to maintain the Ayrton-Jones balance in good condition, and to obtain results equal in precision to those obtained at the present time.

Turning to the absolute measurement of resistance, for many years no measurements of this quantity have been carried out, but at the present time the Lorenz apparatus at the National Physical Laboratory and other apparatus now being constructed at Berlin and Washington will place measurements of resistance in a position equally satisfactory with those of current. The Lorenz apparatus is now being employed for the measurement of resistance, and it is believed that the probable error will not exceed two parts in 100,000. This satisfactory state of affairs is largely due to the design and size of the apparatus and the ease with which the dimensions of the coils can be measured. Many years ago Lord Rayleigh showed that it was not necessary to measure accurately the diameter of the coils of a Joule balance; the ratio of the diameters was sufficient, and this ratio could at any time be obtained by measuring the ratio of two currents. In consequence, with a Joule balance an observer is not handicapped in his measurements by the results of linear observations which may have been made many years previously, and which may be incorrect owing to secular change. With the Lorenz apparatus independence of previous linear measurements has been secured by winding the coils with bare copper wire, and leaving them in this condition. This enables linear measurements to be made at any time with ease and with precision.

Referring to material standards, it is most gratifying to record that measurements of resistance, of current, and of electromotive force are now made on the same basis in practically all civilised countries. This satisfactory state has been achieved within the past four years, and is a direct result of the labours of the London Conference of 1908, in which this Committee was so largely interested.

As is well known, the International standard of resistance is that of a specified column of mercury, and that of current depends on measurements with the silver voltameter. The measurement of electromotive force and of current may be conveniently made by means of the Weston normal cell.

During the past two years comparisons of resistance coils and of standard cells, and comparative experiments with the silver voltameter, have been made by representatives of the National Physical Laboratory and the standardising laboratories of America, France and Germany. The results obtained show the remarkable agreement which now exists between the electrical standards of the four countries named.

The Committee feel that the primary objects for which they were appointed have been achieved, and that the present position of electrical standards—as outlined in this report—is very satisfactory. With a view to completing the business arrangements connected with the republication, the Committee recommend that they be reappointed, that Lord Rayleigh be chairman and Dr. R. T. Glazebrook secretary.

The Determination of the Stresses in Springs.

By E. G. Coker, M.A., D.Sc., Professor of Mechanical Engineering in the City and Guilds of London Technical College, Finsbury.

(*Section G. Abstract.*)

The principal difficulties in determining experimentally the stress in a body of complicated form usually arise from the great variation of stress intensity as we pass from any point to a neighbouring one in the body, and hence any alterations of form and configuration produced by stress and capable of measurement, such as the deflection of a spring, afford little or no information of the condition of stress in the body, unless we are able to formulate a theory of the behaviour of the structure in agreement with the measurements obtainable by experimental means.

In some kinds of springs these conditions are fulfilled very nearly, and it is not difficult, for example, to calculate very approximately the stresses in a helical spring due to a given deflection. In other forms, such as plate springs, the conditions are less favourable, since experiments show that, where plates are built up into a matrix, the rubbing friction between the surfaces in contact is often so considerable that the spring taken as a whole cannot be treated as an elastic body, although each of its separate plates may be considered as such. It is suggested that in some cases experiments on models made of transparent materials may prove of use in determining the stresses in springs built up of curved plates, or constructed from a ribbon coiled in a plane, as in a watch-spring. Experimental comparisons of the stresses in steel and ome transparent materials show that the effects produced are very similar, and we may therefore obtain a fair approximation to the stress distribution in a steel spring by an optical examination of a transparent model. A general idea of the stress intensity throughout the whole model can often be obtained by a visual examination.

Optical methods must necessarily be confined to models; but this objection may be entirely removed if advantage is taken of the thermal properties of materials under stress, the fundamental facts of which were discovered and investigated by Thomson and Joule. It is easy to show that a metal, when subjected to stress within the elastic limit, experiences a very small change of temperature—a diminution for tension stress and an increase for compression stress—and this alteration is proportional to the load applied. This change of temperature can be readily shown by a thermopile; and, as an example, fig. 1 shows some observations obtained for the case of a tension member subjected to a uniformly increasing load, and rising to a maximum of 21,000 lb. per sq. in. The galvanometer deflections, plotted on a time base, show the diminution of

temperature experienced; and since the bar is continually tending to return to thermal equilibrium with the surrounding atmosphere, a correction must be applied to the readings. The correcting factor may be readily obtained from the tail of the experimental curve, and the modified readings then follow the curve shown by II; they are now proportional to the time, and therefore to the rate of application of the load. This and other experimental results show that the thermal effect is proportional to the stress for the whole range of elastic deformation in both tension and compression.

Experiment also shows that the thermal effects produced in a beam subjected to bending correspond to the known stresses across the transverse sections. The case of pure shear is of considerable interest, since it may be regarded as the result of compression and tension stresses of equal intensities at right angles, and the sum of

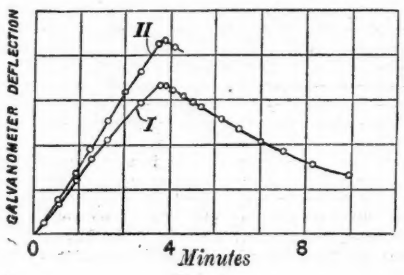


Fig. 1.

the thermal effects is zero. On the other hand, the optical effect of a shear is proportional to the arithmetical sum of the principal stresses at a point. Both methods of experiment may be advantageously employed in many cases, and in some investigations now in progress on springs and plates of various forms, the results obtained optically are being examined independently by thermal tests. For example, the optical effect of two equal-like principal stresses at a point produces a dark field between crossed Nicols similar to that observed in places where there is no stress at all, so that both cases give the same optical effect. Thermal measurements, however, distinguish between these cases and afford a measurement of the stress distribution where an optical test fails.

The principal difficulty in the application of thermal measurement is in the very small range of temperature—less than 0·05° C. per 1,000 lb. of stress for steel—and the large corrections which are required to allow for the exchanges of heat with surrounding bodies. A third mode of investigation of the stresses in springs and other bodies is offered by the permanent electrical differences between stressed and unstressed metals, a phenomenon discovered by Lord Kelvin. The potential difference available within the elastic limits of a material like steel or wrought-iron is, however, very small, and some experiments made for the purposes of the present paper show that it is less than 0·2 microvolt per 1° C. of difference between hot and cold junctions.

The Water-Power Possibilities of the Highlands.*

"The Economic Aspect of Scottish Water-Power" was the subject of an interesting contribution by Mr. A. Newlands, M.Inst.C.E., assistant engineer of the Highland Railway, who said the economic waste represented by the non-utilisation of the water-power possibilities of the Scottish Highlands was at last beginning to receive the somewhat belated attention of industrial life. The north and west of Scotland had the greatest extent of elevated area and the greatest rainfall in the British Isles, with the possible exception of Cumberland, in England. Various estimates of the amount of water-power available in Scotland had been made, and Prof. Forbes, F.R.S., had put the figure at 1,000,000 H.P.

Even if one-half of this amount were accepted, it represented, on a basis of 5 lb. of coal per H.P.-hour, 3½ million tons of coal per annum. This, at 10s. per ton, was worth £1,750,000, which was probably an extremely conservative estimate of the annual value of the Scottish water-power.

The great centres of industry had become too congested and too expensive for the workers. Their housing conditions were unsatisfactory. Rents and taxes were high, and the distractions and expense of large cities were a burden. Employers, on the other hand, were being increasingly hampered by the restrictions imposed on them by combinations of labour, by insurance and liability for workers, and by the restraint of Government supervision, and when to these were added an increased taxation and a rising wages bill, it was easy to account for the growing oncost charges which now represented such a heavy tax on production. The solution lay in the creation of an industrial development in the country districts, and the north of Scotland had exceptional advantages to offer, both by reason of its natural resources and its geographical location. The hydro-electric possibilities of the north were in themselves sufficient to attract and encourage an industrial development, but to these could be added a fine, healthy country population, eager to take up any employment offered to them. Industry in any form could be carried on, as imported raw material could be laid down on the Highland seaboard as easily as in the Midlands of England. The growth of population consequent upon an industrial development such as this would, on a moderate estimate, be not less than five persons per H.P. utilised, so that 45,000 H.P. would create a new population equal to that of the four most northern counties in the mainland. The whole subject was one well worthy the attention of the State, and Mr. Newlands suggested that the policy of State afforestation should be associated with that of water-power development, and that the funds in the hands of the Development Commissioners should be made available for the control and purchase of water rights and development of power as an initiatory step.

Sir Henry Cunynghame, the president, said the importance of the subject was tremendous. The project which Mr. Newlands advocated meant placing at the disposal of the people of Scotland what was equivalent to the produce of a very considerable coalfield—but without the smoke. They might have the whole energy of the water of the Highlands utilised in the service of man without any person seeing anything that would offend his artistic sense. Electricity, unlike steam, could be separated; if they had the industries, they could distribute them all over the place. They need not have the population in cities at all, but could have the people scattered, carrying on such industries as agriculture in summer and other industries, made available by electricity, in winter. He considered that this was one of the most important papers in the whole British Association.

Dr. Scott said that with regard to the Scottish Highlands there were certain difficulties, and one was the cost of transport. With a denser population, however, that would tend to come down.

Mr. W. F. Reid said that unless they worked such a scheme on a very large scale electricity became too costly, and he inquired whether the landowners in the neighbourhood of these sources of power would grant land on reasonable conditions of tenure.

Mr. Newlands, in reply, said as to transport facilities in the North of Scotland there was not a part of the mainland more than 20 miles from the seaboard. He believed that the landlords would sacrifice personal interests if it could be shown that the development of such a scheme would be for the advantage of the Highlands generally, but they would probably resist the attempts of speculators and others who endeavoured to buy up water rights with the view of selling at a profit later on.

* See also Elec. Rev., May 31st, 1912, p. 874.

The Transmission of Heat.

Mr. C. H. Lander, M.Sc., and Prof. J. E. Petavel, F.R.S., described an experimental investigation of the transmission of heat from heated metal cylinders to the surrounding air, which has a direct bearing on the lagging of steam pipes; the temperatures, however, ranged up to 2,000° F., and the pressure in the air

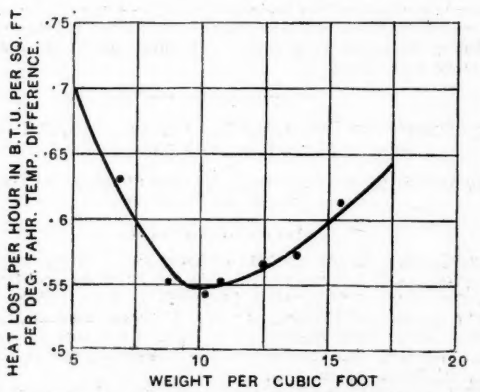


Fig. 1.—Effect of Density of Covering on Heat Loss.

enclosure was varied from atmospheric up to 3,000 lb. per sq. in. In the case of steam pipes, the heat loss per hour per sq. ft. per degree F. difference of temperature was measured, with the following results:—

Bare steam pipes containing saturated steam at atmospheric pressure and at 100 lb. per sq. in. gauge pressure, external atmosphere at 60° F.:—

External diameter of radiator, in.	Heat loss per hour in B.TH.U. per sq. ft. per degree F. At atmospheric pressure.	At 100 lb. per sq. in.	Conduction only, taking $\kappa = 0{\cdot}144$*.	
0·2	3·94	6·0	0·39	Assuming layer of air to be 4 in. thick round radiator.
1	3·00	4·0	0·13	
2	2·55	2·8	0·089	
3	2·30	2·4	0·074	
5	2.05	2·1	0·060	
12	1·97	—	0·047	

* The constant K is given in B.TH.U. per hour per square foot of surface per degree F. temperature difference for a layer 1 in. thick.

Under the conditions described, the loss of heat is mainly due to convection. In the case of a pipe, for example, 1 in. in diameter, containing steam at atmospheric pressure, the loss by radiation is 0·44 or 15 per cent., and by conduction 0·13 or 4 per cent., so that 81 per cent. is dissipated by convection; at 100 lb. per sq. in. the

loss by convection would be about 80 per cent. If the surface of the metal were machined, the loss by radiation would be halved, and if it were polished the loss would be reduced to one quarter.

As all lagging materials are better heat conductors than air, they increase the loss due to conduction; it is necessary, therefore, to arrange them loosely, so as to sub-divide the air space surrounding the pipe as perfectly as possible with the least amount of solid material. The lagging can, however, be too loosely packed, as will be seen in fig. 1, which shows the effect of slag wool under various conditions as regards density of packing. The best result was obtained when the solid material occupied $\frac{1}{12}$ of the total space; the conduction loss was then increased from 0·13 to 0·40, but (assuming radiation to be zero) the convection loss was reduced from 3·2 to 0·14, the total loss being $\frac{1}{4}$ of that observed with the bare pipe.

The loss by radiation per sq. ft. from small pipes diminishes rapidly as the diameter increases, but above 4 in. diameter it becomes nearly constant.

A New Machine for Alternating Load Tests.

By Bernard P. Haigh, B.Sc., Assoc.M.Inst.C.E.

(Section G. Abstract.)

During the discussion that followed Mr. Eden's recent paper on the endurance of metals, references were made to the use of an alternating magnetic flux for producing a pulsating pull in a specimen, and some brief notes were also contributed by the author, describing a machine of this class which had been in use in the James Watt Engineering Laboratories of the University of Glasgow (where it was constructed) for some months.

The present machine is of small size, being intended primarily for testing wire with direct pulls varying up to about 1 cwt.

The construction of the machine is shown in fig. 1, and its principle is illustrated diagrammatically in fig. 2. The lower end of the specimen, W, is attached to the armature A. This is a laminated block of iron, supported on flat springs giving freedom for vertical motion in a small range, directly over the pole P_1 of the magnet. A magnetic flux (indicated by chain lines) is produced by the large coil C, and passes across from the armature to the main pole P_1, thence back to the subsidiary poles P_2 and P_3 by means of the laminated yoke. The total air-gap in the circuit is made small, so that a coil of moderate size is sufficient to produce a very strong flux in the air-gap, developing a strong pull between the pole-face and armature.

When the density of the flux on the pole-face is B lines per sq. cm., the magnetic pull per sq. cm. is given by the expression (Maxwell's law)

$$F = B^2/8\pi \text{ dynes per cm}^2.$$

Taking the area of the pole-face as A sq. cm., the total magnetic flux is (A × B) lines, and the electromotive force induced in each turn of the magnetising coil is—

$$E = 4{\cdot}44\, c\, (A \times B)\, 10^{-8} \text{ volts},$$

where c is the frequency of the alternating current supplied, measured in complete cycles per second. The magnetic pull F is therefore proportional to the square of the ratio of volts to cycles—*i.e.*,

$$F = k\,(E/c)^2.$$

This holds good so long as a constant proportion of the total magnetic flux passes across the gap—*i.e.*, so long as the leakage flux which passes between the sides of the armature and the pole P_1 is a constant proportion of the whole. If this were strictly the case, the pull would depend only on the ratio volts to cycles, and it would be immaterial whether the air-gap varied or not. In practice, however, the leakage flux varies with the gap, and it is therefore important to keep the leakage as small as possible. The leakage flux is proportional to the width of the gap and to the periphery of the vibrator, while the useful flux is proportional to its area; hence it follows that it is important to work with approximately constant gap, and, further, that a large machine (in which the ratio of the periphery to the area is small) is easier to design than a small one, such as that which has been built. Even in this small machine, however, the pulsating pull is fairly constant with respect to variations in the air-gap. The pull increases somewhat as the gap is reduced, and it is sometimes necessary to manipulate the machine skilfully so as to keep the gap constant in spite of slight instability. In a larger machine this would be unnecessary, as the "leakage factor" would be constant.

The small coil C^1 is connected directly to a sensitive voltmeter, and acts like the secondary winding of a transformer. It is introduced so that the voltmeter readings from which the load is deduced may be as far as possible free from leakage errors. The coil is therefore wound with fine wire very close to the edges of the pole-face, so that the greater part of the leakage flux passes outside the coil. In this way the constant k in the equation for the pull becomes almost independent of the size of the gap.

It is not difficult to control the air-gap within the desirable limits when the specimen is not too long. A low-power microscope fitted with a graduated scale in the eye-pieces is handy for the purpose, and allows the range of vibration under any given load to be read off at the same time that any adjustment is being made. When a test of long duration at a given pull is being carried out, it is more convenient to employ an ammeter to measure the magnetising current. As this current is directly proportional to the mean length of the air-gap (for a given flux density), it is a very simple matter to keep the two constant.

If it were possible to avoid eddy currents in the pole-piece P_1 and armature, the strength of the magnetic pull would not depend upon the frequency, but only on the ratio voltage to frequency. In practice, however, the laminations are more or less short-circuited, and eddy-currents are induced which drive the flux to the outside of the pole, increasing the leakage and reducing the pull. As the strength of the eddy-currents is proportional to the frequency, while the pull is proportional to the square of the flux, the pull varies slightly with the frequency, and the machine must be standardised for a number of different frequencies.

It is necessary to use fairly thin stampings, effectively insulated from one another, in order that the flux may be uniformly distributed over the pole face.

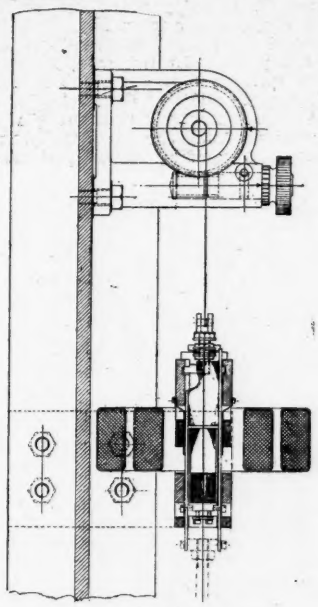


Fig. 1.

The flat springs S_1, S_2 which carry the armature, are primarily arranged so as to guide the armature A between the poles P_2 and P_3, keeping its lower face parallel to that of the pole-piece P_1. By using springs instead of lubricated guides, one ensures the absence of friction, which might easily become a large (and variable) quantity. When working with high frequencies, even the air resistance of the armature and its attachments becomes a measureable quantity, although generally so small as to be negligible.

The lateral stresses are small so long as the air-gaps on the two side poles P_2 and P_3 are equal. Thus the lower spring S_1 is of quite light material, similar to that used in clock springs, and serves only to keep the armature central. It is attached to the armature by the side plates, which pass on either side of the main pole P_1, and is held at the ends by clips D, D attached to the frame holding the yoke.

The upper spring S_2 is made of much heavier material, as it serves the extra purpose of compensating the inertia forces required for accelerating and decelerating the mass of the armature. Although the mass and amplitude are both small, the force required is considerable, as the frequency may be high. The stiffness of the

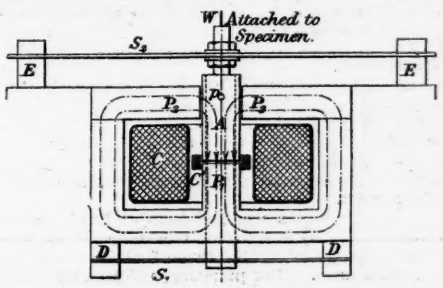


Fig. 2.

springs may be adjusted to suit the frequency of the test by moving the clamping saddles E, E inwards or outwards on the upper part of the frame.

It appears desirable to work with a wave of sine shape, as this means that the test is being carried out at one definite frequency, and not with a combination of several frequencies corresponding respectively to those of the fundamental and several harmonics.

The use of a sine wave has the practical advantage that the inertia stresses can be compensated more fully.

To ensure compensation it is sufficient to arrange a spring of the proper strength, so that its rest position, when carrying the weight of the armature, is at the mid-point of the range of vibration required. If the spring is pulled out of this position when vibrating, so that the mid-point of the range no longer corresponds to the rest position, then the specimen will be subjected to a corresponding steady pull, in addition to the pulsating pull of the magnet.

It is easy to provide springs of suitable dimensions to cover a wide range of frequency, provided the armature is kept as light as possible. Lightness is also desirable, in order to minimise the magnitude of the correction.

As shown in the drawing, the spring S_2 (which is, in reality, in two parts) is clipped between nuts on a screwed spindle secured to the top of the armature. By adjusting the two nuts together, the

rest position of the armature is moved upwards or downwards as required. The armature may be held in its central position while this adjustment is made, by means of the pin p passing through the frames; and in the same way the saddles may be adjusted sideways without any chance of the armature being drawn against either of the lateral poles P_2 or P_3.

It is not necessary in practice to make any calculations when adjusting the span of the springs to suit any particular frequency, for this is more simply and more reliably done by experiment. When the stiffness of the springs is just right for compensating the inertia force at any particular frequency, the natural period of oscillation of the spring and mass together is just equal to this frequency. It may be said that the mechanical system is "in resonance" with the magnetic pull (provided that no specimen is attached, increasing the total stiffness of the system). To determine the frequency corresponding to any particular span of the

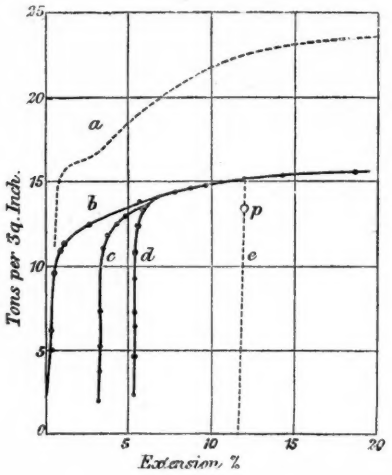


Fig. 3.

springs, it is only necessary gradually to raise the speed of the alternator until the armature vibrates with wide amplitude with an almost negligible pull. A range from 120 to 35 extensions per second is obtainable with one set of springs, and other springs might be substituted for other ranges if so desired.

Having now dealt with the inertia forces, we may turn to the method of standardising the machine, whereby the constant K may be determined experimentally—

$$F_{max.} = K E^2/e,$$

where E is the voltage induced in the small measuring coil, and e is the frequency—*i.e.*, the number of extensions per second.

This method consists essentially in determining the mean value of the pull of the magnet. When this is known, together with the wave shape of the magnetic flux, the maximum value of the pull is readily deduced. Thus, when the flux follows a sine wave, the pull follows a sine wave of double frequency, and the mean value is exactly one-half of the maximum. The ratio is easily calculated for other waves when the wave form has been determined by the oscillograph.

When standardising the machine, the specimen is replaced by a standard spring, and the inertia of the system is increased by attaching a comparatively heavy mass to the armature. The standard spring is extended until the heavy weight is lifted, and the armature "floats" at its normal level, vibrating in only a very small range, as the extra mass is so great in comparison with the pull of the magnet.

We may now apply a modified form of Newton's law, which states that when a body is vibrating in a constant range with any one, or more, frequencies, the sum of all the constant forces applied must be zero. The pulsating unidirectional pull of the magnet may be regarded as made up of two components; first, a constant pull equal to the mean value: and, secondly, an alternating pull varying in a sine wave. In the case of the armature the four constant forces acting upon its mass, together with the heavy mass attached, are:—

1. The mean value of the magnetic pull.
2. The pull of the standard spring.
3. The force of the control spring (nil).
4. The weight of the armature and the mass attached.

Equating the sum of these four to zero, we deduce that the mean value of the magnetic pull is equal to the pull in the spring less the total weight.

An extra (standard) weight is added, so that the stiffness of the spring may be determined by measurement of the extension necessary to lift the armature back to its normal position. The voltage and frequency are noted, and also the extension of the standard spring necessary to overcome the mean value of the magnetic pull.

The mean value of the pull is thus directly comparable with the standard weight, the values being proportional to the extensions produced. It is, of course, necessary to use a number of standard weights so as to verify the proportionality of the extension of the standard spring to its load within the working range.

The heavy mass for standardising is attached below the armature by means of the extended side plates, which are also used in connection with the guiding spring S_1.

The spring is extended by a small winding drum with worm-gear, which also serves for adjusting the specimen under test. This worm-gear is marked off into divisions which serve as a micrometer, so that the permanent extension of a specimen may be measured by simply noting the angle through which the drum has been turned to maintain the required position of the armature.

Up to the present only a limited number of materials have been tested under pulsating load in the machine, and it may suffice to give some preliminary results obtained from two materials standing at almost opposite extremes of the long range of carbon steels used in the form of wire.

The first of these is a low carbon (0·15 per cent.) annealed wire, breaking under a steady stress of about 24 tons per sq. in., with 20 per cent. extension, while the second is a hard-drawn steel of higher carbon (0·47 per cent.), breaking at about 160 tons per sq. in. with 1·7 per cent. extension.

The results obtained from the ductile material are shown in fig. 3, in which curve a represents the autographic stress-strain diagram obtained with a steady load. This test was made with Dr. Barr's wire-testing machine, adjusted so that the duration of loading was 15 minutes. Curve b represents the extension of the same material under a pulsating load applied with a frequency of 62 per second. It is clear that extension begins at a much earlier stress, and that the maximum load does not exceed 16 tons per sq. in., which is very close to the yield-point under steady load. It is also remarkable that the percentage extension is very approximately the same for the two curves. Curve b represents the greatest extension that has been obtained from a number of specimens. It will be understood that it is not easy to maintain a constant air-gap when extension is so rapid as indicated by the flat curve b. The fractures were carefully examined, and do not appear to differ noticeably from those obtained with steady load; in both cases the characteristic local extension of a ductile material was formed. Curves c and d represent the stress-strain diagrams obtained with pulsating load when the specimen had been previously strained with steady pull and released, leaving respectively 3 per cent. and 5 per cent. permanent extension. The curves rise steeply, and afterwards follow curve b; the total extension was again 20 per cent. It is noticeable that curves c and d are rounded off as they join b, and that the rounding appears less with 5 per cent. than with 3 per cent. initial extension. When part of the extension has been carried out with pulsating load, and then subsequently continued, curve e is obtained. There is no apparent rounding off at the junction of curves e and b, but extension recommences sharply when the load reaches its former value. An interval of rest of 24 hours does not appear to alter this result.

When the specimen has been extended by pulsating load, and the load is then somewhat released, say 10 per cent., to the point represented by p, it does not appear that any further extension occurs—at any rate after a very short period has elapsed. The reduced load may be reapplied at least 2,000,000 times without further extension, and when fracture occurs it is at the grips, probably due to hammering.

Hard-drawn metals are still more difficult to grip, as the stresses are so high that slipping, on the one hand, and fracture by hammering on the other, are very difficult to avoid. It appears that the strength with a pulsating load is not greatly less than that with a steady load. Thus the better specimens broke with a stress of about 120 tons per sq. in. pulsating, combined with 20 tons per sq. in. steady (applied with the object of minimising vibration) giving a total stress of about 140 tons per sq. in., as compared with about 160 tons per sq. in obtained in tests with steady load.

Up to the present no clear evidence of fatigue has been found either in ductile or hard-drawn materials. It would appear that ductility is not advantageous in wire subjected to a rapidly pulsating load. On the other hand, the hard-drawn material appears to retain a greater proportion of its strength when tested under a pulsating load.

Gaseous Explosions.

The fifth report of the Committee appointed for the investigation of gaseous explosions was submitted. It embodied a short review of the present state of knowledge with regard to the flow of heat from the working substance of a gas engine into the cylinder walls. One of the most important questions is the rate at which heat goes into each part of the surface, and the resulting mean distribution of temperature. The greater part of the heat flow occurs in a short time immediately after ignition, and passes therefore into the surface of the combustion chamber and valves and the face of the piston; Dr. Dugald Clerk calculates that the actual rate of flow of heat per sq. ft. per second in the first three-tenths of the stroke is six times that of the whole stroke, in ordinary gas engines at full load, without including radiation before the attainment of maximum temperature. A thin badly-conducting deposit of carbon may materially reduce heat-flow. Radiation is an important, if not the principal, agent in the transfer of heat from the gas to the metal.

An important practical consequence of this is the greatly increased loss of heat which occurs when the mean pressure in an engine is increased by increasing the strength of the mixture. The jacket loss and the metal temperatures are raised in a much greater proportion than the fuel consumption, and the efficiency is diminished. In very large engines this sets a fairly sharp limit to the possible output, which is, as a rule, considerably less than the maximum of which the engine would be capable if it were given all the fuel that it could take. If the load be in excess of this

limit the engine overheats rapidly in consequence of the greatly increased heat flow.

The effect of radiation is necessarily to make the heat loss per unit area from a large volume greater than that from a small volume, because the walls receive radiation from the inner layers as well as from the portions nearer to them. The experiments of W. T. David show that the transparency of the products of an explosion while still at a high temperature is very great, and lead to the conclusion that the heat loss per unit area from a mass of glowing gas would go on increasing with the volume of the mass until that volume was comparable with the largest sizes of gas-engine cylinder now made.

One practical aspect of this question is the relation between size and thermal efficiency. In so far as heat flow increases with the volume, the efficiency of large and small engines will become more nearly the same. Of even greater importance practically is the absolute amount of heat flow per square foot, since it is this which determines the internal temperatures, and so sets a limit to the output of the engine. The results cited show broadly that this quantity must be considerably greater in an engine of, say, 3-ft. bore than in one whose cylinder diameter is only one foot, and that the difficulty of designing and working the first is not alone due to the greater thickness of metal, but also to the greater heat flow.

The density of the gas in a gas-engine explosion is from four to seven times that of the atmosphere. In the Diesel engine it is, of course, very much greater. The effect of this factor is greatly to increase the heat flow as compared with an ordinary closed-vessel explosion, where the density is that of the atmosphere.

The most important practical question connected with the relation between density and heat loss is the effect of degree of compression on the working and efficiency of gas engines.

The conclusion gained from practical experience, that there is a point beyond which it will not pay to increase the compression in the gas engine, is in full accord with the results of laboratory experiments on the relation between density and heat flow. Not only is there a point beyond which increasing compression is not followed by an increase in efficiency, but before that point is reached the flow of heat per unit area is increased to an amount at which trouble will begin to arise on account of the difficulty of cooling.

During the suction stroke of a gas engine, or during the period of injection in an engine charged from a separate compressor, the mixture of gas and air which is subsequently to be exploded enters the engine through the valves or ports at a high velocity, so that the gas within the cylinder is in a state of eddying or turbulent motion. This motion gradually dies away after the valves are closed, but will persist for some time during the compression stroke, so that at the moment of explosion there may still be a good deal of turbulence. In consequence of this motion of the gas the convection of heat will go on more rapidly, and what may be called the "effective conductivity" of the gas will be increased.

Clerk found that the result of damping down the turbulence was to retard the rate of inflammation of the gas to a very remarkable extent, so that the character of the diagram was completely altered. If ignition be delayed until the combustible mixture taken into the engine has been compressed and expanded twice and then again compressed, the period of inflammation is about two and a half times that of a normal ignition in which the gases have some turbulent motion. Were it not for this fact, it would hardly be possible to work internal-combustion engines at reasonably high speeds, because the ignition would be too slow. It now appears that this is wholly, or almost wholly, due to the fact that the gas in the engine is in turbulent motion.

Other Papers read at the B.A.

The following is a list of papers submitted to Sections A and G, of which abstracts have not been published in our pages, but which are of more or less interest to electrical engineers :—

Section A.—Mathematical and Physical Science.

"The Heating Effect of Radium Emanation and its Products." By Prof. E. Rutherford, F.R.S., and Mr. H. Robinson.

"The Photo-Electric Properties of Thin Metal Films." By Mr. James Robinson.

"On the Discharge by Ultra-Violet Light of High-Speed Electrons." By Prof. R. A. Millikan.

"The Law of the Fall of a Drop through Air at Reduced Pressures, and a Redetermination of *e*." By Prof. R. A. Millikan.

"On a Conductivity imparted to Liquid Air by Alpha Rays." By Prof. J. C. M'Lennan.

"The Origin of the Beta and Gamma Rays from Radio-active Substances." By Prof. E. Rutherford, F.R.S.

"On the Intensity of the Earth's Penetrating Radiation over Land and Large Bodies of Water." By Prof. J. C. M'Lennan.

"Magnetic Disturbances, Sunspots and the Sun's Corona." By Rev. A. L. Cortie, S.J.

"A Machine for Drawing the Curves of Radio-active Changes." By Prof. F. Soddy.

"Photographs of the Arc Spectrum of Nickel under Pressure." By Prof. W. G. Duffield.

"The Current-Potential Curves of the Oscillatory Spark." By Dr. S. R. Milner.

"A Case of Anomalous Conduction in a Solid Dielectric." By Dr. W. F. G. Swann.

"Photographs of a Deposit upon the Poles of an Iron Arc Burning in Air." By Prof. W. G. Duffield and G. E. Collis.

"On the Series Lines in the Arc Spectrum of Mercury and on their Resolution by an Echelon Grating." By Prof. J. C. M'Lennan.

Section G.—Engineering.

"The Acceleration of a Motor-Car." By Mr. H. E. Wimperis.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Equiluxo" Glassware.

The General Electric Co., Ltd., have just brought out a new line of reflectors for use with Osram lamps, under the above title; it is designed to give uniform distribution of light without accompanying glare. The material of which this glassware is made is of a milky appearance, having a limpid translucency like that

Fig. 1.—Distributing Type.

Fig. 2.—Concentrating Type.

of pure white onyx, and thus allows sufficient light to pass through to illuminate the ceiling. The two principal types in which it is made are illustrated in figs. 1 and 2—the distributing and concentrating types—and these are stocked in a variety of sizes. Bowls, hemispheres and spheres are also made of "Equiluxo" ware.

Electric Vacuum Cleaners.

The "Sterdy" vacuum cleaner, which has been put on the English market by Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, E.C., possesses some distinctive features, and bears evidence of skill in the design of the motor, which is the most important part of such an appliance. It has been the aim of the inventors to make the apparatus as light as possible, at the same time sacrificing nothing in regard to reliability and efficiency, and hence they have arrived at an appliance which does not exceed 7 lb. in weight.

Unlike similar appliances, the motor is carried in a vertical position, which permits of the design being lighter than when the motor is carried horizontally.

Fig. 3.—The "Sterdy" Vacuum Cleaner.

Unusual care has been given to the manufacture of the motor, which, in spite of its small size, can be used with safety on circuits of 250 volts, without the necessity of putting a lamp or resistance in circuit with it. Moreover, it is made for alternating-current of almost any periodicity, which is a particularly desirable feature, having regard to the extreme variations that exist in this country, both in regard to voltage and periodicity. Provision is made to secure efficient lubrication, and the bearings are specially designed

to meet the conditions of a vertical motor. Oiling is not necessary more than once a month.

The makers say that in vacuum cleaners it is a rather desirable feature that there should not be any great air pressure, otherwise it might have a detrimental effect on the carpets if the cleaner were used to any great extent; we understand that the design of the "Sterdy" cleaner allows a low air pressure, but provides for a considerable velocity of the air. The fan is made of aluminium, and runs at 5,000 R.P.M.

An important feature, and one which we understand is patented, is the use of a brush in the mouth of the nozzle, which is claimed to have a renovating effect on the carpet after the sweeper has been used.

Foster Transformers.

The Foster Engineering Co., Ltd., of Wimbledon, S.W., who entered transformer manufacture with their well-known auto-transformer, have extended their operations to embrace large

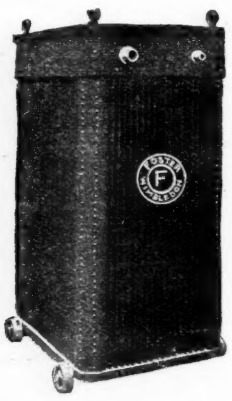


Fig. 4.—Foster Sub-station Transformer.

double-wound sets, and have now standardised a series of oil-filled transformers, ranging from 1 to 100 kw., for various voltages up to 3,000 primary and 550 secondary. The cores are of the finest transformer steel laminations, interleaved at every layer and held together by clamps, no holes being pierced through the plates, and great care is taken with the insulation of the windings, which are treated with the firm's heat-dissipating and fire-proofing process. The sub-station transformer, above 40 kw., is housed in a neat corrugated steel case, mounted on rollers. One of them is shown in fig. 4.

G.E.C. Three-Phase Distribution Box.

A design of three-phase fuse box has been recently standardised by the General Electric Co., Ltd., in which the difficulty of accommodating the numerous cables in any three-phase distribution box, which is not inconveniently long and narrow, has been neatly overcome by placing the fuses for each phase on separate panels mounted in step fashion. The cables from the lower panels are

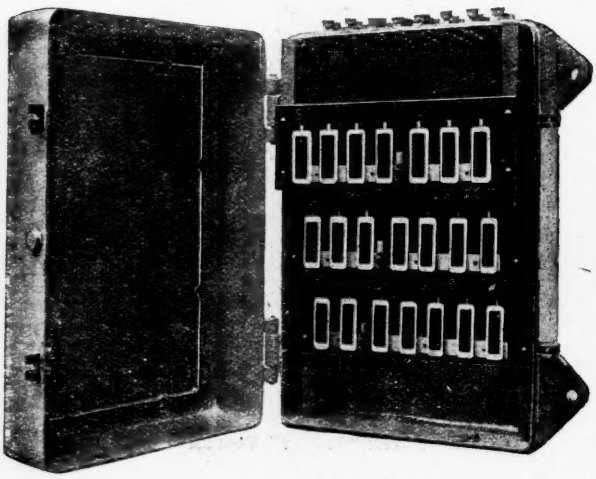


Fig. 5.—G.E.C. Stepped Three-Phase Distribution Box.

run below the upper panels, and all are brought out at the top or bottom as required.

A seven-way waterproof cast-iron distribution box of this type, specially designed for industrial service, is illustrated in fig. 5, but the same design has also been applied to glazed boxes for situations in which they are not liable to accidental damage.

Renewable Cartridge Fuse.

Messrs. Ward & Goldstone, of Springfield Lane, Manchester, have recently introduced a renewable type of cartridge fuse, which we illustrate in section in fig. 6.

In appearance, the "T.A.W." fuse is like the usual cartridge, but with rather more substantial finish, metal parts and tongues. It consists of the usual fibre outside tube, into which is fitted loosely a thick asbestos damping tube, and at each end of the cartridge is the metal attachment, which is fitted into the tube and riveted; a vertical slot is cut into this metal portion, through which the fuse wire is threaded. The milled nut clamps up against the projection of the metal pieces fitted in the ends of the fuses, and thus makes connection to the fuse wire. The tongues of the fuse screw into the cartridge ends, and thus complete this article. Should a fuse blow, a new wire can be fitted in a few moments without difficulty, and there is no sand required for refilling; in fact, the fuse wire can be fitted in these cartridge fuses with the same ease as in an ordinary china fuse. The cost of the fuse is rather more than that

Fig. 6.—The T A.W. Renewable Cartridge Fuse.

of the ordinary type, but in use it will be found much more economical, in view of the fact that it can be re-fused innumerable times.

Belling Electric Geyser.

The accompanying illustration, fig. 7, shows the complete apparatus employed for rapid water heating in connection with the device which we described in a recent issue; it is controlled entirely by the one hand-wheel shown, which turns on the water first and the current afterwards, and *vice versa*, by means of a mechanical

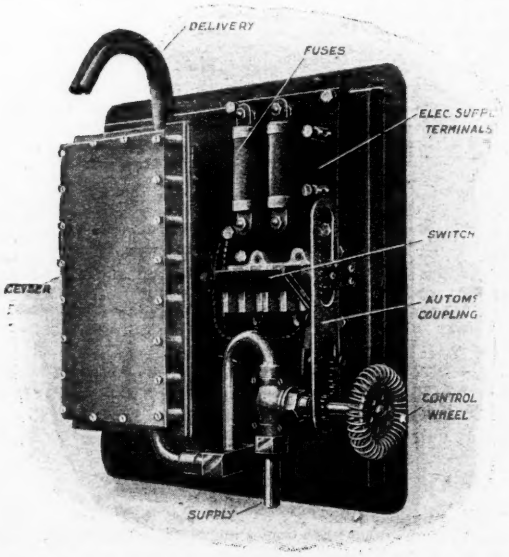


Fig. 7.—"Maze" Pattern, Belling Electric Geyser (Cover Removed).

coupling, so that the apparatus cannot be overheated. The equipment as illustrated is entirely self-contained, and the cover, which is nickel-plated, is provided with a lock and key. The water is supplied at any desired temperature up to boiling point directly the handle is turned, and an efficiency of 95 per cent. is claimed for the device. Messrs. Belling & Co., of Lancaster Works, Enfield, are the makers.

Publicity Literature.—We have received from the Electric Supply Publicity Committee, of 20A, Tudor Street, London, E.C. (chairman, Mr. A. F. Harrison), a budget of samples of a new issue of publicity literature that is now available for electric supply authorities. Heating and cooking are the main subjects covered, the titles of the leaflets designed expressly to boost these applications being: "Heating by Electricity: Comfort without Labour"; "Electric Cooking: Simple, Hygienic, Cool, Safe and Economical" (with pictures of the Shakespeare Electrical Restaurant at Earl's Court); "Chilly Days" (male and female companion leaflets); "The First Necessity: Electricity in small Households"; "Electricity *versus* Coal and the Servant Problem" (a comparison); "Electric Ironing means Cool Work." Other items include a leaflet on "Artistic Effects with Electric Lighting," and "Electric Power for Lifts," and an application card. The Committee's telephone number is "1109 Holborn."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Is Electric Cooking Proceeding on Sound Lines?

About a month ago I wrote a letter to one of your contempories questioning whether electric cooking was advancing on sound lines. Since then I have seen the interesting papers and discussions that took place at the meeting of the Municipal Electrical Association. Nothing has transpired at this meeting to alter my opinions, but rather to intensify them. There must have been many members present who had doubts on the subject, and it seems a pity they did not face these instead of allowing the cooking enthusiasts to alone give their opinions. In my previous letter I took the averaged hours' use of the maximum demand for cooking as about 2½ hours per day. Mr. Long, in support of his ½d. per unit tariff, was content to take a still lower figure, namely, 400 units per annum per kilowatt of maximum demand, or a daily use of a little over one hour per day.

I entirely disagree with Mr. Long's assumption that it is possible to base the average kilowatt demand for cooking purposes at the low figure of 5 per cent. of the total kilowatts demanded by all cooking consumers. The ½d. tariff falls to the ground utterly if one departs from such ideal figure. One, in the ordinary way, cannot obtain such a figure for power loads which are spread over a nine or 10-hour day. It is inconceivable how such a low diversity factor as 5 per cent. can be obtained where a cooking load at night time would only be spread over a maximum of some three hours. Take a fairly good class district, the majority of people will have dinner or high tea between the hours of six and seven. Most of these cooking operations will entail the demand being used for half an hour to one and a half hours and a diversity factor of 25 per cent. would be a much more likely figure.

The manufacturers of cooking appliances are doing a large business and anticipate big increases in the future. As long as they can prevail upon supply undertakings to supply on low tariffs they are sure of a good business, and it is no concern of theirs if the supply authorities afterwards get into difficulties. I am strongly of the opinion that electric cooking, for the regular every day demand, can never become a sound proposition until the apparatus is designed on heat storage lines or the supply of electricity is given by storage. Where cooking is done on a large scale in private houses or in the case of a restaurant, it would, I believe, be a feasible proposition for the consumer to install a small motor generator and charge a few large capacity accumulators throughout the 24 hours of each day. The heating elements would be on massive lines, and mechanical and electrical breakdowns would be almost non-existent. Makers of electric accumulators would do well to work out cooking on these lines and thus open up a new demand for them. The ½d. a unit enthusiast could then be given full play, and if desirable, he could go further still.

With regard to heat storage, I see no reason why cooking appliances cannot be designed on this principle, so that the average sized private house could get all its heat for cooking purposes with a 24-hour supply at from ·3 to ·4 KW. demand. Tariff of ½d. down to ⅜d. per unit could then be granted with every safety. We are making experiments on these lines with promising results, and I suggest that manufacturers could very much better employ their time in this direction. Current for cooking purposes undoubtedly does, in the majority of cases, superimpose itself on the lighting load, and has in addition a poorer load factor than ordinary private house lighting. To sell such a demand at figures of 1d. down to ½d. per unit will, I contend, in time bring about a dangerous financial position to the undertaking.

A Melbourne firm has brought out a well-designed electric cooker taking from 3 to 3½ KW. demand. There are some 200 of these on order, which will shortly be on the Melbourne mains, and the resultant effect of these is being awaited with considerable interest. The annual sale of units for cooking purposes given by Mr. Cooke, of Luton, is most interesting. When one considers the population of Luton, and that they sold 265,374 units last year, it shows the enormous possibilities of electric cooking. This fact emphasises how very carefully one should approach this subject. Personally, until cooking appliances are designed on different principles to those put forward to-day, I am not prepared to push any of them other than small heating apparatus, such as radiators, irons, toasters, kettles, &c.

P. J. Pringle.

Ballarat, *August 28th*, 1912.

Knife Switches.

I shall be obliged if you will grant me the privilege of saying a few words upon the above subject. After reading the correspondence in the last two issues of the ELECTRICAL REVIEW upon switchboard fires, and more particularly Mr. Chas. C. Garrard's, it made me think that if a few lines appeared in the ELECTRICAL REVIEW upon knife switches they might bring forth some useful correspondence from some of our switchgear experts.

Personally, I have been very closely in touch with switchgear design for the past 12 years, and know pretty well the position of the buyer compared with both the manufacturer and his designer.

Mr. Garrard has brought up a subject which has been a trouble to manufacturers for many years, and nowadays the manufacturer makes both live hinge and insulated hinge knife switches, in order to comply with his customers' wishes.

The purchasers are, of course, mostly consulting engineers and central station engineers; these gentlemen send out their specifications for switchgear, and where knife switches are required they invariably insert a clause somewhat as follows:—"Knife switches must be so constructed that the current does not flow through the hinge."

With all due respect to these gentlemen, my experience is that their knowledge of switchgear is almost nil; I should like to ask the majority of them what experience they have had compared with a switchgear designer who has been at the business for many years.

It is true that they are the buyers; but I say, why do they not ask the opinion of manufacturers of experience?

The principle appears to be for them to work on the old-fashioned method, send out specifications with old-fashioned, and in many cases, most absurd clauses, and absolutely ignore the manufacturer. It is now getting a common practice for switchgear engineers to simply glance through specifications, as they are getting familiar with them.

In the case of some switchgear manufacturers, the weak-minded engineer who is responsible for getting out the drawings and estimates simply works blindly to the specification; the result is that the tender is not accepted, due to the price being too high, caused by an expensively-designed switch or switches.

Switches of the "insulated hinge" type are more expensive than those of the "live hinge" type, on account of the extra part, besides the extra space they take up.

In my opinion, switches of the "live hinge" type are preferable if well made, as the hinge contact has several hundred per cent. more contact effect than the spring clip near the hinge of an "insulated hinge" knife switch.

In connecting "live hinge" knife switches to the cables and bus-bars, &c., at the back of switchboards, I have always taken the precaution to connect the "top" or "break" contact to the incoming supply, so that when the switch is in the "off" position the whole of the blade and the bottom contact are "dead." I am sorry to say that I have known switchboard engineers make the connections the reverse way, namely (and I put it down to their ignorance of electrical connections), they couple the bottom contact to the incoming cable, because it is nearer the bottom of the switchboard, and couple the top contact to the bus-bar, because the bus-bar is immediately above it. Perhaps the above is the reason why customers cry out for "insulated hinge" knife switches.

To conclude, I would like to relate the following incident which occurred at the recent Olympia Exhibition. I did not hear it myself, but I did see the knife switch in question, and, if the story is true, it shows what some manufacturers have to contend with. The knife switch was of the single-pole, single-throw, quick-break, live hinge type, and, I should

say, of about 1,200 or 1,500 amperes capacity; it was exhibited by one of our leading switchgear manufacturers.

A visitor during a conversation with the representative on the stand, remarked that it was a large switch to have a live hinge. The representative told him that similar switches were supplied to a certain customer who was very pleased with them. The visitor pointed out to him that the said customer would not have "live hinge" switches, and always inserted the "usual clause" in his specifications to the effect that knife switches must not carry current through the hinges. Imagine the visitor's surprise when he was told that the reason for inserting the usual clause in specifications was simply to prevent other, and mostly smaller, manufacturers from quoting.

Switchgear.

September 30th, 1912.

Switchboard Fires.

I can only assume that Dr. Charles C. Garrard was unable to find time to peruse my previous letter carefully. If he will turn to the letter again, he will find that my remark that switches should be designed so that the current does not pass through the hinge, referred to switches of the ironclad type.

I am aware that there is an open type knife switch on the market carrying current through its hinges, which leaves little, if anything, to be desired, but I think Dr. Garrard will be the first to admit that such a design does not lend itself economically for enclosure in a cast-iron case. Apart altogether from the question of rapid and uncontrollable make and break, it is desirable with enclosed apparatus that the length of arcing surface shall be as great as possible. The best results are obtained when the switch blades are designed to have a double parallel break in series. Fortunately this need not necessarily complicate the construction.

Herbert Berry.
Berry, Skinner & Co.

London, E.C., *October 1st*, 1912.

NEW ZEALAND GOVERNMENT CONTRACTS.

Preference to British Goods.

The following is a copy of a notice issued by the Board of Trade, and referred to in our leaderette on page 523:—

"The attention of the Government of New Zealand has recently been directed to the fact that the right of its Departments to import duty free all goods purchased by them (whether free or dutiable under the Tariff) has, in a number of instances, resulted in the preference accorded by the Tariff law to goods of British origin being nullified in the case of Government purchases. H.M. Trade Commissioner for New Zealand (Mr. W. G. Wickham), who has been in communication with the Government of the Dominion upon the subject, now reports that it has been decided to lay down as a general rule governing all purchases of Government supplies and the acceptance of all Government tenders, that in all such cases there shall be added to the prices quoted for goods not of British origin the excess of duty payable under the tariff on such goods over the amount payable on similar goods of British origin, and unless the price to be paid for the British goods then considerably exceeds the calculated price for foreign goods, the British tender is to be accepted. Where there are special advantages in the quality or character of the foreign goods this rule may be departed from, but only after the submission to the Minister concerned of a report giving detailed reasons for such action."

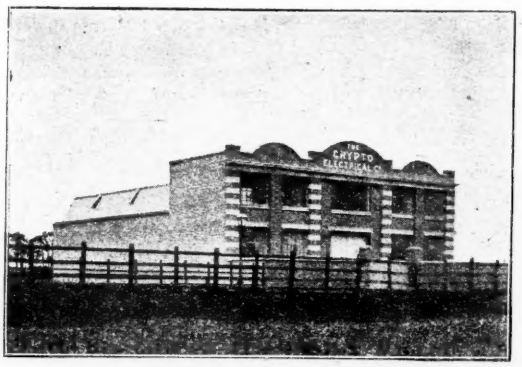
BUSINESS NOTES.

Electrical Trade in South Africa.—The report for 1911 of the British Trade Commissioner for South Africa states that although the major portion of the imports of electrical goods last year was required in connection with the conversion of steam to electrical driving in the mines of the Witwatersrand, municipal and other industrial, as well as domestic requirements, bulk largely in the total value of the imports. In 1907 the value was £813,838, whereas in 1910 the electrical imports increased to £1,444,869, but in 1911 the imports declined by £394,654. The Commissioner expects a further decline in the present year, although he states that a part of the proceeds of the second debentures of £1,000,000 recently issued by the Victoria Falls Power Co. will go towards keeping up the present scale of imports. The hope is expressed that British firms will participate in the placing of these orders, seeing that the issue is not "tied up" with German financial corporations, as on former occasions. The details of the imports are set forth as follows:—

	1907.	1910.	1911.
Electrical machinery	£156,201	£810,292	£534,141
„ fittings (including posts)	76,307	360,392	266,465
„ cables and wires ...	74,254	260,834	229,883
Telegraph and telephone material	7,076	13,351	19,726
Total ...	£313,838	£1,444,869	£1,050,215

In addition to the foregoing the imports of stores for the use of the Union Government comprised electrical machinery of the value of £14,203 in 1911 as compared with £21,658 in 1910; electric cables and wires, £62,632, as against £43,681; electric fittings, £15,184, as contrasted with £24,300, and telegraph and telephone materials of the value of £77,061, as compared with £144,808 in 1910. The imports into Rhodesia, which are also cited separately, scarcely reached a total of £7,000 in 1911, as against £4,300 in the previous year.

New Factory at Willesden.—Owing to a large increase of business, the Crypto Electrical Co. have found that the additions which were made to their Bermondsey Street factory at Christmas, 1911, are insufficient to meet the demand for their standard



The Crypto Company's New Factory.

machines. In order to deal with this increase, they have purchased a larger piece of land at Acton Lane, Willesden, on which they have erected an up-to-date factory, which is now equipped with new labour-saving plant for putting standard pattern machines through in large quantities. This factory will act as an auxiliary to those in Bermondsey Street, which will continue without any alteration.

For Sale.—The buildings, tools, stores, stocks, goodwill of the business, &c., of the Sunbeam Lamp Co., Ltd. (in liquidation), Gateshead, are offered for sale by private treaty.

The Bray U.D.C. have for sale a 75-kw. alternator, with exciter.

The Chinese Engineering and Mining Co., Brussels, has for disposal one Goerlitz compound steam engine of 1,200 e.h.p., coupled to a Siemens-Schuckert three-phase alternator, with exciter, one rotary converter, one three-phase transformer, switch plant, &c.

Mr. A. Warren will, on October 9th and 10th, sell by auction at 22-28, Mossbury Road, Clapham Junction, S.W., the stock and plant of Mr. G. A. Gunn, electrical engineer.

Messrs. P. Huddleston & Co. will, on October 10th, sell by auction, at 16, Long Millgate, Manchester, a quantity of electrical apparatus, &c. See our advertisement pages in this issue.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet (O.S. 1,596) giving illustrations, prices, and particulars of current consumption, cost of burning, &c., of standard type Osram drawn-wire lamps. Contractors can have quantities of the list overprinted as usual.

Messrs. Fyfe, Wilson & Co., 155A, St. Vincent Street, Glasgow.—Eight-page booklet containing testimonials from users of the Kelvin petrol and paraffin-driven electric generating sets.

Messrs. L. Andrew & Co., 2, Whitworth Street West, Deansgate, Manchester.—Price leaflet concerning "Capella" carbon-filament and "Wrendal" metal-filament lamps.

From Messrs. Greenwood & Wells, of 25, York Place, Baker Street, London, W., we have received a 20-page pamphlet entitled "Coal—Treated with a Little Consideration," in which the advantages of coal-testing, the purchase of coal on a calorific value basis, and a number of other matters are referred to, a scale of fees for testing being given.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London, E.C.—Pamphlet giving particulars, with prices, of their "London" and "Henley" tapes.

Messrs. H. & T. Danks (Netherton), Ltd., Netherton, Dudley.—Forty-page catalogue well and fully illustrated, containing full descriptive information relating to their various types of steam boilers, namely, Lancashire, Cornish, "Galloway type," dry-back marine, and the Netherton vertical water tube, also steam fittings, "Sisson" superheaters, steel chimneys, water softeners, heaters, and purifiers, steam cylinders, quick-sealing doors, air receivers, &c.

Messrs. British Insulated and Helsby Cables, Ltd., Prescot.—Two new catalogues. One of 24 pages contains illustrations of, and a great deal of tabular matter (including dimensions and prices) relating to, their several types of "Prescot" enclosed fuses. The other list (eight pages) describes fully (with excellent illustrations), and gives prices of, Prescot joint-boxes.

The Indestructible Cable Co., 20, High Holborn, London, W.C.—Illustrated price list of wood bell pushes, pear pushes, ceiling roses, adapters, &c., made by Messrs. Beran & Kneller.

Messrs. Hick-Diesel Oil Engines, Ltd., 11, Queen Victoria Street, London, E.C.—New and revised catalogue relating to their Diesel engines, with an explanation and description of a typical installation. Diagrams and half-tone views are given. In addition to their low-speed type the company are now making the high-speed type.

Book Notices.—The *Murray Printing Telegraph Journal*, Vol. I, No. 2, was published on August 30th; the first number appeared two years ago, but the editor, Mr. Donald Murray, states that he hopes to publish future numbers at least once a year. In the present issue an account is given of his recent visit to America, where he inspected the various printing telegraph systems, and disposed of the United States rights for the Murray multiplex system to the Western Union Co. The apparatus will be manufactured by the Western Electric Co., which is allied with the Western Union. Mr. Murray was impressed with the merits of the Morkrum Co.'s system, and arranged to represent that company in Europe and other countries outside North America. He remarks that the Baudot alphabet is now generally admitted to be the best for machine telegraphy. Some interesting comments are made on the typewriter position in America. Other notes relate to the extending use of silver as a substitute for platinum contacts, electromagnets instead of permanent magnets in polarised relays, the use of small letters (lower case) without capitals for printing telegraphs, and the rapid progress of the Edison nickel-iron accumulator.

"Der Elektrizitatszahler." By R. Ziegenberg. 1912. Berlin: H. Meusser. Price M 10.

"Magnetic Properties of Alloys." Reprinted from the *Transactions* of the Faraday Society. London: The Faraday Society. Price 7s. 6d.

"*Proceedings* of the Physical Society of London." Vol. XXIV, Part V. August 15th, 1912. London: *Electrician* Printing and Publishing Co. Price 4s.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 6. June, 1912. New York: The Society. Price 75 cents.

Trade Announcements.—Messrs. Isaria, Ltd., 208, Tower Bridge Road, London, S.E., inform us that according to the new Post Office system their registered telegraphic address should read "Isarialim Berm. London." The indicator word Berm. can be left out for foreign telegrams or cablegrams.

Acting on medical advice, Mr. J. A. Brockett, electrician, &c., of Station Square, Whitby, has relinquished his business and sold it to Mr. T. H. Beecroft, and it will in future be conducted by this gentleman.

The *Financial News* Amsterdam correspondent says that Messrs. Philips & Co., of Eindhoven, Holland, who are a considerable factor in the international export trade, have turned their business into a limited liability company. "The issue of 2,200,000 fl. 6 per cent. profit-sharing preference shares was 24 times over-subscribed, and the shares have risen within a few days from 104 to 110 per cent."

The New Garter Foundry Co., Ltd., are removing to more convenient premises at Groveland Foundry, Dudley Port, Staffs.

Messrs. Safety Light, Ltd., have opened showrooms at their new address announced last week (118, Queen Victoria Street, E.C.).

The Indestructible Cable Co., 20, High Holborn, W.C., have recently taken over the agency here for Messrs. Beran & Kneller G.m.b.H., of Potschappel, Germany, manufacturers of electrical bell pushes and all classes of wood turnings for the electrical trade.

Bankruptcy Proceedings.—Albert Edward Martin (trading as the Midland Electrical Supply Co.), electrical engineer, 39, Great Charles Street, Birmingham, Warwick.—The first meeting of creditors herein was held last week at the offices of the Official Receiver, 191, Corporation Street, Birmingham. The statement of affairs showed gross liabilities amounting to £1,262, of which £793 was expected to rank for dividend, and the assets totalled £64, leaving a deficiency of £729. The failure was attributed to want of capital, having to pay interest and insurance premiums in respect of borrowed capital, loss on contracts, and heavy law costs of suing creditors. It appeared that the receiving order was made on the petition of creditors, the act of bankruptcy being that the debtor executed a deed of assignment to a trustee for the benefit of his creditors. It was stated that the debtor was formerly a partner in a business which supplied electrical accessories, from which he drew about £3 10s. weekly. In June, 1908, the partnership was dissolved, the debtor leaving the firm and receiving, as his share of the business, £120. He started business with this amount at Moseley Road, under the style of the Midland Electrical Supply Co. He removed to 69, Great Charles Street in August, 1910, and three months later to 39, Great Charles Street, where he continued to trade until August last, when notice was given to his creditors that he had suspended payment. The books of account have been fairly well kept, but he has not prepared a balance-sheet or profit and loss account since June, 1910. The balance-sheet at that time showed a deficiency of £249. According to a trading account from June, 1910, to the date of the receiving order, a net profit was made of £248 odd, while the household expenses were estimated at £557. The debtor admitted that he became aware of his position in June, 1909, when a friend investigated his affairs. The matter was left in the hands of the Official Receiver.

Osram Week, 1912.—The General Electric Co., Ltd., of Queen Victoria Street, E.C., encouraged by the success of "Osram Week," 1911, have decided to repeat the campaign during the current month. It is hoped that the 1912 "Better Lighting" Campaign, which commences on Monday, October 14th, will be even more successful than that of last year. Our readers will find a fairly full reference to the matter in an advertisement appearing in this issue, and it will be observed that a strong, fully-organised effort will be made during the days named to impress the Osram claims upon the minds of millions of householders, shopkeepers and others, by the medium of a gigantic Press-advertising scheme, by the display of posters on hoardings, by circular letters advising hosts of electricity users, actual and prospective, to consult electrical contractors in their particular district, and so on. We have before us at the time of writing a good deal of explanatory literature, specimen newspaper advertisements, &c., relating to the scheme, upon which an enormous amount of ingenuity and work have been expended. It is not necessary to enter here into all the detailed conditions and advantages affecting electrical contractors and factors who are willing to co-operate with the company in this mutually profitable "sales-making" effort, but we are asked to bring the matter to the notice of all who may be interested, so that they will lose no time in applying for the full particulars, wherein are explained the manner in which their own local businesses may receive a suitable advertisement in the newspaper Press, and the manner in which they can make their own effective Osram electrical exhibition for the week. A special design for a window show will be circulated. Special portfolios and order forms, without names and addresses, have been prepared, and copies of these will be sent to parties prepared to co-operate. If desired, these can be printed with the local firms' names and addresses, but, as will be observed, the time is short.

Dissolutions and Liquidations.—Zedecco Batteries, Ltd.—At a meeting held on August 26th, at 64, Broad Street Avenue, E.C., it was resolved to wind up voluntarily, with Mr. H. A. Kidd as liquidator.

Berry Construction Co., Ltd.—Creditors must send particulars of their debts, &c., to Mr. J. C. Wrist, the liquidator, at the office of the British Electric Transformer Co., Ltd., at Hayes, by November 29th.

Economic Electric Co., Ltd.—A meeting is to be held at 51, North John Street, Liverpool, on November 1st, to hear an account of the winding up from the liquidator, Mr. F. T. P. Deyes.

Sunbeam Lamp Co., Ltd. (in liquidation).—A notice is published in the *London Gazette* for October 1st notifying that by an order of the Court, dated September 13th, Mr. G. E. Corfield, of Balfour House, Finsbury Pavement, E.C., has been appointed an additional liquidator to act jointly with Mr. Thomas Wallace.

Stockall-Brook Time Recorders, Ltd.—A meeting is to be held on October 30th, at Huddersfield, to hear an account of the winding up from the liquidator, Mr. O. Avison.

M. A. Ritter & Co., dealers in rubber, gutta-percha, balata, &c.—Messrs. O., M. A., & O. H. Ritter have dissolved partnership. The business will be continued by Mr. O. Ritter.

LIGHTING and POWER NOTES.

Argentina.—The German Oversea Electric Co., in Buenos Ayres, which supplies yearly upwards of 200,000,000 kw.-hours, and whose works have a capacity of 90,000 kw., is threatened with competition from two quarters. An Italian-Argentine company is seeking a concession from the T.C., and the Compania de Tranvias Lacroze, which is concerned mainly with tramways, but has not yet attempted the construction of the, some time since officially sanctioned, underground railway, is applying for Government confirmation of its right, also to supply light and power in the city. Respecting the application of the former company, the German company has addressed a protest to the T.C., and declared its intention to so cut rates for consumers, when its competition station is ready to begin working, as to destroy the latter's commercial *raison d'être*. The power of the tramway company, with its other schemes in hand, to offer a serious competition with the wealthy German company, is regarded as small.—*Elektrotechnische Zeitschrift.*

Mr. C. F. Moujan, on behalf of a syndicate of Belgian, English, French and North American capitalists, has applied to the Buenos Ayres Municipality for a concession to erect electric power houses for the supply of current for public and private services, the concession to be to December 31st, 1957, when all would revert to the Corporation.—*Review of the River Plate.*

Australia.—According to the *Financier*, it is officially stated that at Altona, eight miles from Melbourne, an extensive area of brown coal has been mined for some time by a local company. This company has now been bought out by a body of English and American capitalists, who have been responsible for the erection of large electrical undertakings in Canada and South America. A power house is to be constructed, and it is stated that up to £3,000,000 for development will be provided, if the industrial development warrants it. The purchasers financed a similar undertaking at Rio Janeiro, the largest individual power scheme in the world. The primary aim of the purchasers is the supply of current for power and lighting to Melbourne and suburbs.

Bainbridge.—The Aysgarth R.D.C. has given Mr. J. Cockburn permission to erect overhead wires at Bainbridge for an electric light installation.

Ballybay (County Monaghan).—A scheme is on hand for the electric lighting of Ballybay. The town has been surveyed and plans and specifications made out.

Bexhill.—As a result of the Council's appeal, the net assessment of the electric light undertaking has been reduced from £1.600 to £1,300.

It has been decided to lay cables to provide for the lighting of the new road to Sidley, St. George's Road and St. David's Avenue, at a cost of £343, and to establish a sub-station to meet the requirements of the rapidly developing district at Little Common.

With regard to certain suggestions for using electric light surpluses for the relief of the rates, the town clerk has drawn the attention of the Council to a section of the order, which states that, after paying interest on the money borrowed, &c., a reserve fund must be formed from the profits of the undertaking, and until it reaches a figure of 10 per cent. on the capital borrowed, no money is to be paid in relief of rates. According to this, the Council should have a reserve fund of £7,400, whereas it only amounts to £1,224, and it would, therefore, be a very long time before any money could be paid in relief of rates.

Birmingham.—It is proposed to erect a new boiler house at Summer Lane electricity generating station at an estimated cost of £12,894.

Blackburn.—Reporting further to the Electricity Committee on the necessity for a new power station, Mr. Wheelwright, the electrical engineer, states that the sacrifice involved will not be great. The total capital raised up to March 25th was £293,199, of which £286,055 has been actually expended, leaving a balance of £7,144. A sum of £99,673 (practically one-third) of the capital raised had been paid off, leaving an outstanding debt of £193,526. This figure represented, in addition to the balance of £7,144, an expenditure, firstly, on the mains and distributing system, &c., of £97.765, which would not be affected by the proposals: and, secondly, a capital of £88,617 actually represented by the Jubilee Street works. In its final condition as a transforming station this would have a substantial capital value of about 50 per cent. of this figure, which reduction he confidently anticipated would be more than balanced by the larger margin between cost and revenue on sales of energy from the new works. A suitable position for the new generating station should be obtained adjoining the railway and canal on the outskirts, and as near as possible to a good power district. After careful investigation he suggested that a portion of the Greenbank estate, owned by the Corporation Gas Committee, would satisfy the main points, and the close proximity of the gas works might possibly bring about the use of gas for boiler firing. "I have no hesitation," adds the engineer, "in stating that the necessary capital to build and equip a generating station of equal capacity will be very much less than one built 10 or 15 years ago In view of the demand for power now in sight, additional provision will be required for the winter of 1914 to 1915, and as it will take from 12 to 18 months to carry out the scheme, the obtaining of the sanction of the L.G.B., and the erection and equipping of the station, the question should be considered at once."

Bolton.—The Electricity Committee has decided to ask the Finance Committee to direct application to be made for sanction to borrow £120,000 for the purposes of the proposed generating station at Back-o'-th'-Bank. It was also resolved that the structural work at the new station be carried out in ferro-concrete and brick.

Bristol.—The B. of G. has decided to have the electric light installed at Stapleton Workhouse, at present lit by gas, at an estimated cost of £1,016.

Canada.—The Ontario Hydro-Electric Commission has expropriated the Chats Falls, near Ottawa, from the owners. The offer made by the Commission is $2,000. The owners ask $3,000,000, quite a margin between the offering price and the price asked. The falls are very valuable, and according to our correspondent, probably worth the price asked, as it is possible to develop 150,000 H.P., and they are only 28 miles from Ottawa, which expects to obtain what power it requires from that source.

The Winnipeg ratepayers have endorsed a by-law giving the Council power to spend $750,000 on an electric distribution system.

At Sandy Falls, eight miles north-west of the Hollinger gold mine, Porcupine, Ont., the Porcupine Power Co. has installed an electric power plant for the purpose of supplying power to the district. The installation consists of two generators of 1,500 H.P. each, and a third unit can be added. This company is now supplying light and power to the towns of Porcupine and South Porcupine, and to the Hollinger, McEnaney, Plenaurum and Dome Mines. The mines are now in the fortunate position of having power developed for them almost before they can utilise it.

The Ontario Hydro-Electric Commission has prepared a book of "Regulations and Rules for Inside Work." These have been framed with the object of ensuring that the design, materials, construction, equipment, workmanship and maintenance of electrical work and installations throughout Ontario, as well as repairs, alterations or extensions thereto, shall be in accordance with the best commercial practice, and that the interests of the public, workmen and others, shall be duly guarded, both with regard to safety, to life, limb and property, and convenience. These regulations are being sent out to the different companies and individuals who are interested.

Our correspondent adds: "There is a great deal of poor wiring in this country. A short time back the chairman of the Board of Underwriters, Montreal, wrote the City of Ottawa to at once appoint an electrical inspector, permanently, and have all wiring into buildings inspected, as they were led to believe, and rightly, that there was much very poor wiring in the buildings of the city."

The Quebec Light, Heat, Power and Railway Co. showed earnings for the year ending June 30th, 1912, equal to 2·11 per cent. on the common stock, after all charges, save dividends, had been provided for. This meant that had no dividends been paid, the surplus for the year would have been $211,200. The fixed charges of the past year were $204,000 more than in the previous year, while the amount written off to organising expenses was $7,000 less this year than last. A French representative was present, and asked certain questions with respect to expenditures on the Quebec and Saquenoy railway, which were not answered. Light was expected to be thrown upon the situation as respects the relationship between the Quebec Railway and the Quebec and Saquenoy, but none was forthcoming, though Sir Rodolphe Forget was present. This retinence on the part of the company has caused some suspicion, which is not to the ultimate interest of the company, nor to that of the Quebec financier, Sir Rodolphe Forget.

The Ottawa municipal electrical undertaking will show bigger profits this year than last, notwithstanding the fact that the management cut their rates for lighting almost in half a year ago. Much more light is being used this year than last, and nearly double the number of lamps are used by consumers. Ottawa uses more lamps than any city in America, it is said, averaging out at four lamps *per capita*.

Cheltenham.—The B. of G. has accepted the offer of the borough electrical engineer, Mr. Bache, to draw up a specification and approximate estimate of the cost of installing the E.L. at the Workhouse premises. A return of the gas and fuel consumed in the Workhouse is to be prepared.

Consett.—The Durham County Council has accepted the offer of the Durham County Electric Power Co. to extend the mains so as to supply current to the Consett secondary school, the Council to pay £39, £25 of which is to be repaid when the extended main is utilised for public lighting next year.

Continental Notes.—FRANCE.—The Energie Electrique du Littoral Méditerranéen has placed an order with the Thomson-Houston Co. for the supply and installation of the plant at the transformer station to be built at Pennes, in connection with the supply of current to the city of Marseilles. The plant will first consist of a single group of four transformers, one a reserve; but ultimately the equipment will comprise nine 4,000-KW. single-phase transformers. The present order includes accessory material, comprising a 40-KW. transformer for the auxiliary service, a battery of accumulators, and a motor-generator group for lighting service, with distribution switchboard, instruments and connections, both for 45,000 volts and 13,000 volts, the former being the pressure of the supply from the stations at Brillanne and Ventavon, and the latter that of the distribution in Marseilles. The Thomson-Houston Co. has also been entrusted with the equipment of the Eguilles transformer station destined to serve sectionally the high-pressure lines from the Brillanne station, transmitting current to Arles, Pennes and Allauch, and also for feeding sundry lines at 18,500 volts pressure, serving the district distribution.—*La Lumière Electrique.*

L'Industrie Africaine is the style of company just floated in Paris with a capital of 900,000 fr., with the object of building a generating station at Grand Bassam on the Ivory Coast, West Africa.

Dewsbury.—Application is to be made to the L.G.B. by the Corporation for sanction to borrow £14,500 to allow of an increase in plant at the works in Bradford Road. Turbine equipment will absorb a great amount of the money asked for.

Dundee.—Extensions estimated to cost £49,000 are proposed for the Corporation electricity department. The Scottish Office has granted the full borrowing powers applied for, namely, £68,000, and the Corporation has, therefore, resolved to obtain estimates for the electrical plant required.

East Ham.—The abstract of accounts of the electricity undertaking for the year ended March 31st last, shows a gross profit of £11,933, as against £11,258 in the previous year. After providing for interest on and repayment of loans and income-tax on profits, there remains a net profit of £1,907, as against £2,127 in 1911.

Edinburgh.—Two cooling towers have just been erected in connection with the Corporation electric lighting station; in their construction new features are shown differing from towers at central stations in other parts of the country and also abroad. Hitherto these structures have been of wood, and very little attention has been paid to the architectural side. The new towers at Edinburgh

are each 40 ft. square at the base and 139 ft. high. Although the site is surrounded by high buildings the towers are conspicuous objects. A railway tunnel is near at hand, and, owing to that and the nature of the subsoil, attention had to be paid to the foundations. Standard sections of rolled steel joists and channels, in combination with cast-iron plates, are used for the construction of the base, and for the upper part of the towers stamped steel plates are used in conjunction with cast-iron gratings. It is estimated that the whole scheme, including turbine machinery and condensing plant, will cost about £45,000. This extra plant will be capable of producing about 3½ million units a year, and the saving in coal will represent over £10,000 a year. Opposition was at first made to the erection of the towers on the score of amenity, but the design followed out imparts to the structures rather an ornamental effect, stone being adopted to add to the substantial appearance of the lofty buildings.

By appropriating the electric lighting surplus of £2,000, the Corporation has been able to "scrape through" without increasing the municipal rates. At the monthly meeting of the T.C. there was some plain speaking on the subject, one member describing the proposal to apply the surplus to the relief of the rates as "cowardly finance." In moving that the surplus be put to the reduction of the capital debt on the undertaking, Mr. Stevenson gave it as his opinion that the principle of charging the users of a commodity, of which they had a monopoly, more than they ought to be charged, in order to relieve the general ratepayer, was unjust and inequitable. It practically meant that they were charging the users of electric light their rates twice over. Mr. Bruce Lindsay, in supporting the motion, characterised the proposal as bad business and bad finance. It was a piece of opportunism and simply scraping through, and grabbing here and there for anything that would give the Council or the treasurer the credit of not increasing the city rates. Mr. Harrison moved that the surplus be applied to the relief of the rates. The Lord Provost said not only had the T.C reduced the period from 30 to 25 years for the clearing off of the debt, but it had cleared off during the last year something like £4,000, which might very well have been put to capital expenditure. If every undertaking in the city was in the same condition as the electric lighting undertaking, there would be a very different story to tell. By 27 votes to 16 it was agreed to appropriate the surplus for the rates.

Gillingham (Kent).—The T.C. proposes to extend the plant at the electricity works by installing a second Diesel engine of a larger type. The total outlay is expected to be about £6,000.

Glasgow.—The city electrical engineer has been instructed to prepare plans for the erection of a generating station on ground acquired some time ago by the electricity department in the east end of the city.

Great Harwood.—With reference to the electricity scheme for the district, a deputation of councillors visited Bispham on Thursday last week to see the actual working of a system suggested by Mr. J. Speight, the electrical engineer, who is at present advising the Great Harwood U.D.C.

Halifax.—The E.L. Committee has instructed the town clerk to endeavour to obtain the sanction of the L.G.B. to the Corporation borrowing £4,200 for transformers and £2,600 for switchgear, which, it is expected, will be required at the electricity works during a period of two years.

Hendon.—At the last meeting of the R.D.C., a letter was received from the North Metropolitan Electric Supply Co., stating that, in addition to lighting the Edgware Road through Edgware by electricity, it was supplying other consumers with current, and had therefore decided that it would be better to obtain the sanction of the Council to supply power in the district. A discussion ensued upon the matter, in which strong objection was raised to giving the company a monopoly over Pinner. In the result, the matter was adjourned for inquiry.

Itchen.—The U.D.C. has decided to apply to the B. of T. for a prov. order for electric lighting. The estimated cost of a scheme is £14,500.

Kendal.—In connection with the electricity undertaking, application is to be made to the L.G.B. for sanction to borrow £1,000—£800 for new cables, £100 for new services, and £100 for new meters.

Leeds.—The reasons which actuated the Tramways and Electricity Committee in suggesting the inauguration of a hiring department for electric motors were explained to the Leeds Chamber of Trade at its meeting on Monday by Mr. Robert Armitage, M.P. He said the cost of energy was being reduced, and would represent a loss to the Corporation of about £8,000 per annum, but it would be able to recoup itself through the great increase in the use of motors. The authorities thought the establishment of a motor-hiring department would tend to increase the use of motors still further. A resolution was passed opposing any extension of municipal trading in the direction indicated.

Leicester.—By a majority of one the Corporation has adopted a recommendation of the Tramways and Electricity Committee to apply for powers to supply electric motors, arc lamps, cooking, heating and other utensils and fittings, so as to be able to let them out or sell them if need be. Councillors Baker, Thurley and Carver strongly opposed the recommendation, urging that the Corporation in asking for these powers would not be acting fairly and honestly to a very large section of the ratepayers, many of whom had laid themselves out specially to supply electric light fittings.

Leyton.—The Electric Lighting Committee has reconsidered and amended the figures of its estimate for the half-year ending March 31st next, with the result that the estimated deficiency for the half-year has been decreased from £732 to £320.

London.—Shoreditch.—The borough electrical engineer has lodged formal notice of objection to the proposed fees which have been adopted by the L.C.C. as payable by undertakers in respect of duties performed by the County Council's inspectors in inspecting testing stations, -viz., for the first three testing stations, or less, in the same area of supply £10 per year; for each additional station in the same area £2 per year.

Poplar.—It has been decided to seal an agreement with the L.C.C. for the supply of electricity for lighting Blackwall Tunnel and working the pumps. The agreement provides for not less than 100,000 units per annum, and up to 50 KW., the normal being 25 KW., at a price of '96d. per unit, and is to cover a period of five years, subject to reduction of the charges to correspond with any reduction made by the Borough Council to other consumers. An agreement with the Port of London Authority is also to be sealed, varying former agreements for a supply to the docks and the rental of wayleaves. The charge for energy is put at '6d. per unit, with a minimum consumption of 750,000 units additional for general purposes, and an approximate consumption of 100,000 units for working the Millwall dry-dock pumps. The minimum consumption is to be increased by 5,000 units for every kilowatt demanded in any year in excess of the maximum of 150 KW. for general purposes during the Council's peaks. In connection with the conference convened by the L.C.C., on the subject of electricity supply in London, the Council has decided to inform the L.C.C. that no good purpose would be served by such conferences, but that, as there is in existence a conference of East London municipal electricity undertakings, the Executive Committee of that conference should be invited to meet the L.C.C. Committee as a body.

Woolwich.—The B.C. has circularised the other metropolitan authorities, expressing the opinion that the proposals of the L.C.C. to reduce the maximum periods for repayment of future loans for electric lighting purposes—viz., buildings 30 years, instead of 42 years; mains 25 years, instead of 30 years; and plant and machinery 15 years, instead of 20—are prejudicial to the development of electricity undertakings, and asking the various Councils concerned if they are prepared to join in representations to be made to the Finance Committee of the L.C.C. to reconsider the matter.

Marylebone.—The present 70 and 110-watt lamps in 17 roads are to be increased to 160 watts. The extra candle-power will amount to 17,735. The general manager of the undertaking reports that the Council's scheme of eight selected contractors is working smoothly. Even odd jobs are not carried out by the department, an arrangement having been arrived at with two or three of the eight contractors to supply men for these jobs at a percentage on the labour cost, and it is therefore a fact that cannot possibly be questioned that the Council is carrying out no wiring work except through contractors.

Stepney.—Application is to be made to the L.C.C. for sanction to the borrowing of £10,250 for defraying the cost of mains in connection with the undertaking.

Hammersmith.—Application is to be made to the L.C.C. for sanction to borrow £3,000 for the purposes of the electricity undertaking.

Morley.—The Corporation electricity accounts show that there has been an increase in the expenditure, compared with the previous year, the amounts being £3,858 and £3,702; the increase is mainly accounted for by the advance in the price of coal and the cost of distribution. The receipts amounted to £3,075, and showed a deficit for the year of £783, as compared with the receipts, amounting to £3,172, and a deficit of £530, in the previous year.

Ottery St. Mary.—On Monday evening the first public supply of electric light for the town of Ottery St. Mary, East Devon, was switched on by Lord Coleridge at the factory, in the presence of members of the Urban Council and a large number of townspeople. The power which drives the dynamo, supplying a large battery of accumulators, is water taken from the River Otter. The turbine drives all the machinery at the factory in addition to the dynamo. The company responsible for the introduction of the new illuminant into the town is the Ottery St. Mary Electric Light and Power Co., and Mr. E. R. F. Coleberd is the proprietor.

Rotherham.—The Electricity Committee, on the advice of the electrical engineer (Mr. Cross), has recommended the T.C. to install an additional 1,000-KW. turbo-alternator.

Salford.—The Electricity Committee of the T.C. has accepted the offer of Mr. T. Roland Wollaston, M.I.M.E., Manchester, to provide detail designs and specifications of additional filtration plant for the bore-hole water at the electricity works, to obtain competitive tenders and to superintend the construction, at a fee of 20 guineas, with a further payment of 60 guineas, six months after starting the plant, provided that the added apparatus consistently removes from the softened water 95 per cent. of the present suspended matter.

Application is to be made to the L.G.B. for sanction to borrow the sum of £25,000 to defray the anticipated expenditure on the installation of mains and service cables during the next few years.

Shipston-on-Stour.—The P.C. has requested the Worcestershire C.C. forthwith to grant permission for Messrs Brown & Parsons, Ltd., of Leamington, contractors for the E.L.

scheme, to erect poles and overhead wires in the town for public lighting. Delay has arisen owing to a petition sent to the C.C. by 40 ratepayers asking that permission to erect the poles be refused "as there was an efficient gas works in the town, and the E.L. was not necessary."

Shotton.—The question of a supply of electricity for lighting was raised at the meeting of the Hawarden R.D.C. on Friday last, and it was decided to call a public meeting in order to ascertain the local feeling. Mr. Monsdale pointed out that the subject had been under consideration for 12 months, and it was time something was decided. If the people of Shotton objected to electric lighting they would then proceed with a scheme for Queensferry and Sandycroft, because the people felt that they wanted electricity there.

South Africa.—At a recent special meeting of the Ladybrand T.C., an electric lighting scheme was discussed. The scheme proposed to light the town would cost something like £5,000, and the annual cost would be about £1,100, whilst the revenue was set down at the latter figure. The matter was adjourned for further inquiries into public and private lighting.

Stoke-on-Trent.—The T.C. has applied to the L.G.B. for a loan of £16,969, in respect of sums spent on the electricity undertakings and not sanctioned by the board.

Southborough.—The U.D.C. on September 20th decided to obtain from Mr. W. C. C. Hawtayne a report as to the supply of electricity to the town, with a view to considering the advisability of obtaining a prov. order. Mr. T. W. Horne said they should approach the Tunbridge Wells T.C., the Tonbridge U.D.C., and the Kent Electrical Power Co. to see on what terms they would supply current in bulk, as he considered a £3,000 scheme too large for the town. He added that he understood that Tunbridge Wells T.C. could give a bulk supply, and that the cost of cables would be about £1,000. His proposal that this should be done was rejected by nine votes to four.

Swansea.—The Council's existing agreement with the Anglo-French Nickel Co. regarding rates for the supply of current is to be terminated, and the company is now to be charged the following rates as from April 1st last:—2d. per unit for the first hour per diem, and 1d. per unit afterwards, such number of units so charged being determined by the maximum demand at any time during any quarter, and that 2½ per cent. discount be allowed for prompt payment.

Tyldesley (Lancs.).—The Finance and General Purposes Committee of the U.D.C. has had an interview with Mr. Taite, the engineer and manager of the Lancashire Electric Power Co., who outlined the steps taken by his company for providing electric light for the district. Arrangements had been made with the South Lancashire Tramways Co. whereby electricity would be supplied in bulk for distribution in the township. This supply would be available within a short time after securing a site on which to erect a transforming station. In reply to the Chairman, Mr. Taite said his company was not prepared, on the terms suggested by the Council, to entertain the proposal to re-transfer, and would only do so upon certain stipulations (to be arranged) as to the company supplying large consumers. Subsequently the Committee decided to postpone further consideration of the matter in order that the clerk might prepare and submit a report upon the terms of the agreement under which the order was transferred to the power company.

Uckfield (Sussex).—The R.D.C. on Monday referred to a Committee the question of applying for a prov. order for E.L. in respect to the parish of Crowborough. The local gas company has given notice of its intention to apply for an order, and the object of the Council is to protect its rights.

Walthamstow.—The lighting superintendent has been directed to submit a report upon installing a system of automatic lighting and extinguishing for the public street lamps. A report is also to be prepared by the electrical engineer upon the question of converting of the whole of the public street lamps to electricity. Negotiations are to be carried out with the Woodford Council with respect to the supply of electricity in bulk to that Council. Owing to the metal-filament lamps placed in certain cars proving very satisfactory, the tramways manager has been instructed to similarly equip the remainder of the Council's cars.

West Bromwich.—The Corporation has decided to apply for sanction to borrow £6,500 for additional plant for the supply of electricity, to meet the increased demands for power purposes, particularly those of Messrs. Braithwaite & Kirk, which firm has agreed to take a supply of at least 80,000 units per annum for the next five years.

Wimbledon.—The Fixed Price Light Co., Ltd., has been authorised to wire for electric lighting purposes, certain buildings belonging to the Council in Durnsford Road. In consequence of a recent breakdown at the electricity works of a 1,000-KW. turbo-alternator, a Sub-Committee has been appointed to consider the desirability, or otherwise, of providing additional generating plant.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The Aberdeen Suburban Tramways Co. has under consideration a proposal to introduce the railless traction system between Bieldside and Culter, and between Stoneywood and Dyce. In connection with this matter representatives of the company recently paid a visit to Dundee to see the system in operation there.

Australia.—During the current financial year, 130 new electric cars have been put into service on the New South Wales Government lines, 10 more than are in service in the whole of Victoria, and the orders for the next financial year exceed this year's by 50 per cent. The electrical equipment, axles and tires are imported from England, but the complete cars, underframes and trucks, are constructed and equipped in the State. The Ultimo plant has been increased to over 30,000 KW., and an order has been given for the first instalment of machinery for a new power house now being constructed at White Bay, with provision for 7,000-KW. units. Provision is being made at this new station for the use of more than 1,000 tons of coal daily. The station is designed for construction and operation in complete separate units, so that pace may the more easily be kept with engineering progress.

Bolton.—The Sunday service of cars has for many years commenced at noon, and an effort has been made by some of the townspeople to secure the running of occasional cars on certain routes earlier in the day. The Committee has now decided not to entertain the question of running cars on Sunday mornings.

Colne.—At a recent meeting of the T.C., Alderman Hewitt gave notice of his intention to move at the next monthly meeting of the Council that the latter agree to accept an offer recently made by the Colne and Trawden Light Railway Co. to sell its undertaking to the Corporation, the amount of the purchase to be fixed by arbitration.

Continental Notes.—BELGIUM.—The Ghent Tramways Co. has just secured the concession for two new lines of electric tramway in the town of Ghent.

RUSSIA.—For the construction of an electric railway from Moscow to Podolsk, with a branch to Obiratowka, of an aggregate extent of 55·5 versts, there has been formed at Moscow a company, with a capital of 2,500,000 roubles in shares, and 7,500,000 roubles in bonds.—*Elek. Zeitschritt.*

Croydon.—The Sub-Committee appointed by the County Council to report as to suggested extensions of the tramway has inspected various routes, and finds that certain districts are sufficiently populated to render the extensions justifiable, but, having in view the decision of the Council to seek powers to run motor-omnibuses, and bearing in mind that it would take some time to obtain powers for tramway extensions and for works to be carried out, it has decided to take no action in the matter at present. Application is to be made to the B. of T. for an order permitting the Corporation to give a supply of electricity to the works at Beddington of Lacy-Hulbert & Co., Ltd. The cost of extending mains is put at £900.

Doncaster.—The Council's apparent laxity in providing tramway facilities for the suburban residents at Warmsworth and Conisboro' is providing a good deal of discussion locally, and it is hoped that ere long the Corporation will see its way to extend the present system to the two places mentioned, and so put the last links to the chain of tramways which would then extend without a break from Sheffield right up the Don valley to Doncaster.

East Ham.—The tramways accounts show a gross profit of £16,339, as against £7,424 in the preceding year, and after providing for interest on and repayment of loans, the net profit for the year amounts to £3,854, as against a loss of £4,647 last year.

East Kent.—The Light Railway Commissioners have submitted to the B. of T. for confirmation an order authorising the construction by the East Kent Light Railway Co., for light railways from Wingham to Stodmarsh, and from Great Mongeham to Ripple, places in the new colliery area.

Edinburgh.—The report by Mr. Campbell, the burgh engineer, on new systems of tramway traction and their application to proposed extensions in Edinburgh has been discussed by the special sub-Committee of the Corporation Tramways Committee, but no definite decision has been arrived at. The report suggests three routes for consideration as suitable for extension purposes—the northern route, extending from Blackhall on the west and ending at Pilrig on the east; the central route, beginning at Ardmillan Terrace on the west and extending to the Tron Church in High Street; and a southern route. The railless trolley system is suggested as suitable for the northern and central routes. Dealing with the advantages and disadvantages of the railless trolley system, the burgh engineer says it is useful as a "feeder" to an existing tramway system, and for testing the demand for a new traffic route, and as the first instalment of an eventual tramway. The disadvantages as applied to Edinburgh is that the system requires overhead equipment, it is rather severe upon macadan road surface, particularly upon the descent of a hill; it is not quite so economical in working as the self-propelled tramcar, and dust is created by its passage. There is no doubt, however,

that the railless electric trolley car presents particular advantages as applicable to the existing needs and conditions of the city.

Glasgow.—Some difficulty has been experienced in Glasgow, as well as in other cities where the local T.C. has to contend with heavy vehicular traffic. Here there are differences of opinion as to the class of material with which streets traversed by tramway rails should be laid. Recently the Tramway Committee met representatives of the Sub-Committee on Streets and Footpaths Repair, &c., who expressed the opinion that nidged setts ought to be put down in streets in which tramways are laid, and instructions were given to the general manager to report on the matter.

Halifax.—The Tramways and Electricity Committee of the T.C. proposes to purchase from the Commercial Car Hirers, Ltd., of London, a motor-omnibus for the sum of £830, and also to ask that it may be empowered to give an order for two additional 'buses at the same price. A 'bus from the London company has already been on trial, and with a load of 40 passengers (about 5½ tons) took the incline up Mount Tabor with comparative ease. The two additional cars are to be specially designed to cope with the steep gradients on the routes upon which they will run.

Leeds.—The Tramways and Electricity Committee has decided to recommend the City Council to apply for the necessary powers for carrying out various extensions of the tramway system, including the continuation of the railless traction system from Guiseley to Otley and Ilkley, and from Farnley to Drighlington.

A sub-committee was appointed to consider the question of the revision of tramway fares and the possibility of utilising more spare cars on Saturdays and at holiday times. At present there are a number of cars always in the depôts, and they cannot be run owing to the shortage of men to run them. If some of the spare men at the depôts could be utilised as conductors and some of the conductors who are qualified drivers were given their opportunity of taking the better position, it was felt that the difficulty experienced at present might be got over, as the public would benefit by the augmented service.

Leicester.—The Tramways and Electricity Committee recommends the T.C. to extend the electric tramways in six areas of the town, viz., Loughborough Road, Overton Road, Evington Road, Welford Road, Knighton Fields Road East, Cavendish Road, and King Richard's Road, the scheme involving an expenditure of about £100,000. The Council is also asked to seek powers to run petrol motor vehicles, instead of the proposed railless electric cars, to Thurmaston.

Liverpool.—The Mersey Docks and Harbour Board, as a result of complaints from steamship companies as to inconvenience owing to the steepness of the structure, has decided to convert the floor of No. 6 Bridge of the Prince's Landing Stage, Liverpool, into two moving electric platforms, travelling in reverse directions, to facilitate the passing of passengers' luggage, &c., from the Prince's Parade to the landing stage, and *vice versa*. The estimated cost of the alteration is £3,000.

Rotherham.—The railless traction system to Maltby is to be opened for traffic during this week. Three cars are to be used in connection with the route, and the full fare is 6d., with lesser amounts for shorter distances. The cars are rubber-tired vehicles accommodating 28 passengers, and equipped with 40-H.P. motors.

Soyland.—The U.D.C. has passed a resolution in favour of the electric tramways being extended from Halifax to Ripponden on terms to be arranged. Halifax T.C. requires a guarantee of £100 a year against loss, and this is looked upon as an exceedingly fair offer, as £300 a year was originally asked for.

Stainland.—The Council has agreed to accept the offer of the Halifax Corporation to run motor-'buses from the tramway terminus at West Vale to the Vicarage, Stainland, provided the necessary Parliamentary powers are obtained; the District Council will contribute a sum not exceeding £134 per annum for five years towards the loss in any one financial year.

Swansea.—The borough electrical engineer has been directed to proceed with the preparation of the necessary plans, specifications, estimates, &c., in connection with the overhead equipment of the various sections of the tramways proposed to be constructed under the Swansea Corporation Act, 1912, and tenders are to be invited for the various works in connection therewith. Plans, specifications, &c., are also to be prepared by the surveyor for the laying of the permanent way of the above-mentioned tramways. The General Purposes Committee has decided to instruct Mr. Stephen Sellon and Mr. Philip Dawson to advise the Corporation, independently of each other, at a fee of 25 guineas and travelling expenses each, as regards the suggested tramways at Townhill.

Walthamstow.—The Light Railways Committee has decided to purchase four double-deck, roof-covered cars, and to carry out extensions to the car-shed to provide accommodation for these cars; also to double the tramway track at Kite's Corner, Billett Lane and Forest Road.

Warrington.—The Whitley and Stretton P.C.'s having petitioned the Tramways Committee for a car service between Stockton Heath and Stretton, the Corporation tramway manager has been instructed to report upon the cost of a petrol-electric motor-'bus.

TELEGRAPH and TELEPHONE NOTES.

Argentina.—The Argentine Marconi Co. has entered into arrangements with the Argentine Government for the erection of a high-power station to communicate with Europe, North America, China, Japan, and the Australasian Archipelago.

Cheap Telephones.—Telephone call boxes are to be provided in the streets of several German cities, at which the charge per call will be a halfpenny.

High-Frequency Generators.—It is reported that the rivalry between the two types of high-frequency generators which have been introduced in Germany during the past 12 months threatens to lead to legal proceedings as to the validity of the patent rights of one of the machines. On the one hand, there is the Goldschmidt generator, which was first announced to the public, and for the international working of which outside of Germany there has been formed, as previously mentioned in this journal, the Compagnie Universelle de Télégraphie et Téléphonie Sans Fil, of Paris. On the other, there is the Telefunken Co., which controls the high-frequency generator devised by Count Arco, and which is closely associated with the A.E.G. and the Siemens-Schuckert works. The intimation of the formation of the Compagnie Universelle has induced the Telefunken Co. to announce that the further trials made with the Arco machine have been successful, and the construction of six large generators is proceeding rapidly at the A.E.G. works. The Telefunken Co. adds that a claim has been lodged with the German Patent Office alleging that the Goldschmidt patent is invalid, on the ground of old and prior publication in France. Four large and four small Goldschmidt machines, it is understood, are being made by the Bergmann Electricity Works Co.

High-Speed Wireless Transmission.—On Monday last Marconi's Wireless Telegraph Co., Ltd., gave a demonstration of high-speed automatic transmission and reception at their works, Chelmsford, to representatives of the British Post Office, Admiralty, War Office, Colonial Office, and Crown Agents. The high-speed signals transmitted from Poldhu, Cornwall, where other representatives of the Government were present, were received and recorded at Chelmsford, both by means of a recorder on the principle of a gramophone, and printed on tape.—*Financial News.*

Imperial Wireless.—On the reassembling of Parliament next week, the debate on the agreement between the Post Office and the Marconi Co. will take place; charges have been levelled against the Government to the effect that the agreement creates a monopoly, and that, on the other hand, the Government refrains from legislation requiring all passenger ships to be provided with wireless equipment in view of the protest put forward by the Advisory Committee of the Board of Trade, which alleged that shipowners would be compelled to install Marconi apparatus at great cost.

Long-Distance Telephony.—It is expected that the direct telephone line between Germany and Italy, *via* Switzerland, will be opened for service in the near future. Owing to the great distance, the size of wire chosen is 4½ mm., but the charges for use are comparatively low. The transit line from frontier to frontier in Switzerland has been carried out by the Swiss Telegraph Authorities at their own expense, and Switzerland will levy a charge of 2 fr. for each conversation of three minutes. On the other hand, Germany and Italy will each make a charge of from 1 fr. to 2 fr., according to the zone in which the town is situated whence it is desired to speak. During the night the charges will be reduced to three-fifths of those stated, and monthly subscriptions at half rates will be accepted.

New Wireless Company.—According to the daily Press, a new British company called the Universal Radio Syndicate, Ltd., has been formed to acquire the rights of the Poulsen-Pedersen system of wireless telegraphy, and to establish communication between England and Canada, receiving a subsidy of £15,000 per annum from the Canadian Government.

Sparkless Wireless.—The daily Press states that a French engineer, M. Bethenod, has patented a system which enables several neighbouring telegraph stations to communicate without interfering with each other, ten times more quickly than with submarine cables, and at a tenth of the cost. The invention substitutes sparkless for spark telegraphy, and it is declared that communication can be made by it at a speed of up to 200 words a minute. Moreover, it makes wireless telephony immediately practicable.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—October 15th. Balancer and switchgear for the U.D.C. See "Official Notices" to-day.

Australia.—South Australia.—October 22nd. Telephone switchboard at Port Adelaide, for the P.M.G.'s Department. See "Official Notices" September 13th.

October 23rd.—100 common-battery table telephones, for the P.M.G.'s Department. See "Official Notices" September 13th.

December 17th. Three sections of common battery multiple switchboard and other equipment, for the P.M.G.'s Department. See "Official Notices" to-day.

Victoria.—October 22nd. Fourteen sections of common-battery multiple switchboard, for the P.M.G.'s department. See "Official Notices" September 13th.

October 22nd.—(*a*) 37,000 carbon filament lamps, and (*b*) insulated lead-covered copper cables, for the Melbourne City Council. See "Official Notices" to-day.

November 12th.—Deputy P.M.G., Melbourne. 100 electrical registers. High Commissioner's Office in London.

November 19th.—One mercury vapour converter, for the P.M.G.'s Department. See "Official Notices" to-day. Also two batteries, and a 4-K.V.A. single-phase transformer. High Commissioner in London.

Western Australia.—November 5th. Telephone switchboards to Stores Schedules 222 and 223, for the P.M.G.'s department, Perth. See "Official Notices" to-day.

Austria.—Vienna.—October 24th. The Austrian State Railway authorities in Vienna are inviting tenders for an installation of electric lighting in the railway workshops and material stores at Gmurden.

Crete.—Candia.—October 10th. The date for forwarding tenders for the electric lighting of the City of Candia has been postponed to October 10th.

France.—Dole.—October 26th. Supply and installation of a transformer and an electric motor. Particulars from the Sous-Intendance Militaire, Quartier Bernard, Dole (Jura).

Bourges.—October 10th.—Supply of electric material in four lots—Glow and metal-filament lamps; bronze and copper wire and cable; brushes, bells, reflectors, &c. Particulars from the Ecole de Pyrotechnie, Bourges.

Germany.—Bremen.—October 7th. Tenders are required for the supply, erection and setting in working at the power station at Bremen-Woltersdorf, of a 3,200-KW. steam turbine and a 3-7,000-KW. dynamo set, including condensers. Particulars, 8 marks, from the Abteilung Allgemeine Verwaltung.

Gillingham.—October 22nd. One 500-H.P. Diesel engine and alternator, for the Corporation. See "Official Notices" to-day.

Great Western Railway.—October 14th. Stores for a year. See "Official Notices" September 27th.

Isle of Thanet.—General stores for a year, for the Isle of Thanet Electric Tramways and Lighting Co., Ltd. See "Official Notices" September 20th.

Leeds.—October 7th. The Tramways Committee of the Corporation invites tenders for the supply and erection of a steel building at the permanent way depôt, Leeds. Mr. J. B. Hamilton, general manager.

London.—October 15th.—6,000 steel tires for driving wheels and 5,000 steel tires for pony wheels for electric tramcars for the L.C.C. for a period of 12 months. Chief Officer, L.C.C Tramways, 62, Finsbury Pavement, E.C.

L.C.C.—October 15th. Installation of electric lighting, bells and telephones at the Highgate Secondary School, St. Pancras, N.W. See "Official Notices" to-day.

Maidstone.—October 17th. Coal for a year for the Corporation electricity works. Borough Electrical Engineer, Fair Meadow.

Mansfield.—October 9th. Electric lighting for the Workhouse, Stockwell Gate, Mansfield, for the Guardians. Specification, one guinea, returnable, from Messrs. Vallance & Westwick, architects, Mansfield.

Mexborough.—October 5th. Turbo-generator, condenser and switchgear, for the U.D.C. See "Official Notices" September 13th.

Rotherham.—October 16th. One 1,000-KW. steam turbo-alternator, condensing plant, piping, H.T. switchgear, &c., for the Corporation. See "Official Notices" to-day.

Spain.—October 18th. The municipal authorities of Morales de Toro (province of Zamora) are inviting tenders for the concession for the electric lighting of the town during a period of eight years. Particulars can be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de Morales de Toro (Zamora).

October 14th.—Tenders are being invited by the municipal authorities of Cassadela Sera (province of Gerona) for the concession for the electric lighting of the town during a period of five years.

Tenders are at present being invited by the municipal authorities of Vich, for the concession for the electric lighting of the town during a period of ten years from April 16th, 1913.

November 9th. The Spanish Ministerio de Fomento, in Madrid, are inviting tenders for the concession and working of electric tramways between Vigo and Lavadores, and between Vigo and Arratales. It may be added that a project has, in each case, been submitted by a would-be concessionaire, the concession being only put up for tender in accordance with the practice in Spain.

Watford.—October 15th. One 500-KW. steam alternator and a switchboard machine panel for the U.D.C. See "Official Notices" September 27th.

CLOSED.

Australia.—According to the *Australian Mining Standard*, the following contracts have been placed: P.M.G.'s department, Brisbane:—

Galvanometers, rheostats, condensers, cords, and 60 miles cotton-covered wire (at £3 4s. 6d. per mile).—B.I. & Helsby Cables, Ltd.
Protectors, bells, 443 telephones, &c.—Jas. Paton & Co.
Ebonite cases, heat coils, fuses, &c.—Western Electric Co. (Australia), Ltd.
60 miles wire, at £16 17s. 6d. per mile, and 20 miles, at £8.—Noyes Bros., Ltd.
Galvanometers.—J. Bartram & Son, Ppy., Ltd.
Conductor cords, diaphragms, ear-pieces, &c.—Lawrence & Hanson Electrical Co., Ltd.
Ear-pieces and mouth-pieces.—W. G. Watson & Co., Ltd.
100 tons cast-iron pipes, at £10 2s. per ton.—C. Monteith & Sons.

P.M.G.'s department, Sydney:—

10 miles tinned copper wire, at £10 19s. 9d. per mile, 25 miles ditto, at £8 14s. 3d.—W. T. Henley's Telegraph Works Co., Ltd.
45 miles tinned copper wire, at £8 12s. 6d.—Standard Cable Manufacturing Co., Ltd.
100 Ericsson magneto wall telephones, £122 10s.—Ringdahl & Co.

Victorian Railways:—

Eight electric car bodies, £568 15s. each.—A. Pengelley & Co., Adelaide.

Public Works Department:—

Installation of a Lister-Bruston lighting set at the farm workers' block, Lunatic Asylum, Mont Park, £263.—Messrs. Sutherland & Ashman.

Hopetoun (V.) Electric Supply Installation:—

Suction gas engine, £455.—Noyes Bros., Ltd.
Gas producer, £198.—Cambridge Gas Producer Co.
200-KW. generator, booster and spares, £149; Tudor battery, £438.—McLean and Co.
Equipment, £54.—India-Rubber, Gutta-Percha and Telegraph Works Co.
Equipment, £36.—Noyes Bros., Ltd.
Consumers' meters, £60.—Watson & Co.
Aluminium cable, £98; erection of cable, £221.—McLean & Co.

Beulah (V.) Electric Light Installation:—

Suction gas engine, £455.—Kynochs, Ltd.
Gas producer, £198.—Cambridge Gas Producer Co.
200-KW. generator, booster and spares, £149; Tudor battery, £533.—McLean and Co.
Equipment, £67.—India-Rubber, Gutta-Percha and Telegraph Works Co.
Equipment, £51.—Noyes Bros., Ltd.
Consumers' meters, £60.—Watson & Co.
Aluminium cable, £85.—British Insulated and Helsby Cables, Ltd.
Erection of aluminium cable, £228.—McLean & Co.

The *Australian Mining and Engineering Review* reports that the following tenders have been accepted:—For the Prahran and Malvern Tramways Trust (Vic.):—

Construction of permanent way and erection of poles (contract No. 34), £68,898.—Albion Quarrying Co., Ppy., Ltd.

For the Launceston Tramways:—

233 tons of 90-lb. rails, £1,980; 36 tons of 90-lb. rails, £268.—H. Jones and Co., Hobart.
100 standard 6-lb. irons, and three combination electric cookers, £142.—Pacific Heating Co.

Messrs. John Sharp & Sons (Melbourne) have accepted tenders for supply of electrical plant, to be installed in their timber mills, as follows:—

Overhead electric travelling cranes, one 6-ton, at £611, one 10-ton, £677.—Babcock & Wilcox, Ltd.
Motors, comprising two 3-H.P., two 10-H.P., and one 15-H.P., and equipment, £197 16s.—Pfaff, Pinschof & Co., Ppy., Ltd.

Austria.—The Vienna branch of Messrs. Brown, Boverie and Co., have secured a contract for the establishment of a large central electricity generating station at Kasparberg, Bohemia.

Bolton.—On September 26th the Electricity Committee accepted the tender of Mr. J. B. Scholes for 25,000 tons of coal.

Brighton.—The tender of Mr. H. J. Galliers has been accepted by the Brighton Guardians, at £42, for the supply of electrical fittings.

Derby.—The Electric Lighting Committee of the T.C. has accepted the tender of Messrs. J. A. Aiton & Co., for steam piping, at £187; and that of the Chain Belt Engineering Co., Ltd., for a chute for the coal bunkers, at £46.

Finchley.—The following tenders have been received for a supply of flame arc lamps:—

Jandus Arc Lamp Co.	£296
Union Electric Co.	360
General Electric Co.	372
Engineering and Arc Lamps, Ltd.	314
Crompton & Co.	304

France.—Contracts have been placed by the Société Electrique de l'Eau d'Olle with the firm of Thomson-Houston and Co. for four three-phase 3,750-KW. alternators, 8,000 volts; and for three 5,000-KW. three-phase transformers, 8,000/6,000 volts.

The following orders have also been received by Messrs. Thomson-Houston, Paris:—From the Société Anonyme des Hautes Fourneaux, Forges et Acieries de Denain et Anzin, a complete equipment of steelworks travelling cranes and large plate rolling machines, comprising 21 motors of 21 up to 160-H.P. capacity; from the Hauts Fourneaux de la Chiers, a motor-driven blooming equipment; from the Société Métallurgique de Senelle, an order for a 750-H.P 480-volt motor; and lastly, from the Société des Hauts Fourneaux et Forges d'Allevard, a 300-H.P. 3,000-volt motor for their iron and steel works.

G.P.O.—Messrs. Scholey & Co., Ltd., London, have received a contract for the supply of "Britannia" metallic-filament lamps.

Halifax.—The Tramways Committee has accepted the tender of the Commercial Car Hirers, Ltd., London, at £830, for the supply of a motor-'bus.

The Tramways and Electricity Committee has accepted the tender of Messrs. Siemens Bros., Ltd., for the supply of nine pairs of 40-H.P. motors, for £1,548.

Houghton-le-Spring.—For installing electric light at the hospital, the R.D.C. has accepted the tender of Messrs. S. Stobart and Co., at £32.

Leeds.—The Isaria, Ltd., are now supplying A.C. single-phase meters of their E.V. type to the Corporation electricity works.

London.—KENSINGTON.—The estimate of Messrs. R. Waygood & Co., Ltd., at £49 10s. has been accepted by the Guardians, for repairing the lifts at the Infirmary.

MARYLEBONE.—The B.C. has accepted the following tenders for supplies of coal to the electricity undertaking :—

A. Blackmore & Co.—3,500 tons, at 13s. 6d. per ton, and 3,500 tons, at 14s. 6d.
Myers, Rose & Co.—2,500 tons, at 13s. 6d. per ton, 2,500 tons, at 14s. 6d.
Wm. Cory & Sons.—10,000 tons, at 14s. 3½d. per ton.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Siemens Bros., Ltd., for a high-tension switchboard panel.

River Wear Commission.—A contract has been placed with Messrs. Cowans, Sheldon & Co., Ltd., for four 3-ton portable electric cranes for South Dock, Sunderland.

Rotherham.—The T.C. has accepted the tender of Messrs. Heenan & Froude, for extensions to the refuse destructor, at £5,375.

The Corporation has also placed a contract for meters with Messrs. Chamberlain & Hookham, Ltd., Birmingham.

Rugby.—The U.D.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for three transformers.

Salford.—The T.C. has accepted the tender of the Earl of Ellesmere for an annual supply of 6,000 tons of No. 2 best washed slack, delivered at the electricity works, at 11s. 10d. per ton in barges, and 12s. 4d. per ton in carts. The tender of Adam Bromley & Son has also been accepted for a similar supply of 2,000 tons of pea nuts to the electricity department, at 13s. per ton.

FORTHCOMING EVENTS.

Iron and Steel Institute.—Friday, October 4th. At Leeds. Last day of Autumn Meeting.

Society of Engineers.—Monday, October 7th. At 7.30 p.m. At the I.E.E., Victoria Embankment, W.C. Paper on "Town Planning from an Engineering Aspect," by Mr. E. R. Matthews.

International Engineering Exhibition.—October 4th to 26th inclusive. At Olympia.

Association of Engineers-in-Charge.—Wednesday, October 9th. At 8 p.m. At the St. Bride's Institute, London, E.C. Presidential Address by Dr. H. S. Hele-Shaw.

NOTES.

Legal Query.—A letter was received a few days ago from a correspondent who put to us a legal query relating to a cinematograph theatre, but this has been mislaid, and we have no record of the name or address of the writer. Perhaps when he sees this note he will be so good as to send us a copy of his letter.

Power in Textile Mills.—We are informed that an error occurred in the table of the principal turbine installations in British textile mills, given on page 455 of our issue of September 20th. The alternator installed at Messrs. Ashton Harrison & Co.'s mill is there ascribed to Messrs. Siemens Bros., but was manufactured and supplied by Messrs. Bruce Peebles & Co., Ltd., of Edinburgh, to the specification of Mr. Robt. Blackmore, of Stalybridge.

Inquiries.—A correspondent asks for the name of a maker of a guillotine suitable for armature winders. Makers of tinned steel wire as used in motor manufacture are also asked for.

Electricity in the Schoolroom.—It is reported that experiments made in Stockholm on school children have demonstrated that, by maintaining high-frequency electric oscillations in the room in which they work, their physical and mental development can be materially accelerated, and their work is done with less fatigue. A similar experiment is to be initiated in New York.

The "Standard" Discovers Electrolysis.—A series of sensational articles, under the headlines "What Invention Next?" and "Inventions and Discoveries," has been running in the *Standard* for some weeks; while it may do some good by directing the attention of the general reader to the work that has been and is being accomplished by engineers and scientists, it has not been free from those defects which, somehow, almost invariably creep into the treatment of technical matters in the daily Press. Fanciful speculations as to what may—or may not—conceivably come to pass in the remote future are deftly converted into "intelligent anticipations" of what may quite possibly be realised at an early date; and as the layman has no means of distinguishing between the probable and the fantastic, he may be led to form wholly erroneous ideas regarding such questions as, for instance, the wireless control of airships or the future of tramways and railways. We cannot afford space to comment at any length upon the articles, but may draw attention to one or two flagrant examples of glib nonsense.

Thus, one article was devoted to the marvels of electrochemistry. We were informed that water was a simple chemical compound of hydrogen and oxygen gases, and the writer had the audacity to state that "the great problem before scientists to-day is the discovery of some means whereby water can be decomposed into these constituent gases in an economical manner." "Conviction is rapidly growing that electrochemistry will provide some new and economical method of effecting this decomposition." The object of this imaginary research is to enable ships to travel at high speeds without the aid of coal, oil or wind, *drawing their power from the water on which they move.* Well may they say "What next!"

"An expert engineer intimately associated with the latest uses of applied electrochemistry" is credited with the forecast that at no remote date motor-cars will be driven by electrolysed water, and he sees "no reason at all why, by the use of gas cells, cars should not run between 500 and 600 miles with one charge." This "engineer," we imagine, employed his hat as a telephone for the communication of this information. The same expert, dilating on the advantages of magnetic oxide of iron as a protection against corrosion, declared that a bridge like the Forth Bridge would in future be permanently protected from corrosion *after erection* by a single treatment on electrochemical lines. "Prodigious!"

Objection to Municipal Motor Hiring at Leeds.—At a meeting of the Council of the Leeds Chamber of Commerce, held on Tuesday evening, under the presidency of Mr. F. J. Kitson, discussion took place on the proposal of the Leeds Corporation to borrow £10,000 for the purpose of hiring out motors to users of electric current.

Mr. Wardle drew attention to the project, which he held was a most improper one for a Corporation to undertake, and he said the proposal went altogether beyond the right province of the Corporation.

The chairman said he also thought it did.

Mr. Wardle said it interfered with traders in a most unfair way; not only so, all that municipal employment meant an addition to the number of Corporation officials. It was a very great evil, and he saw no reason why they should do it. If people wanted a motor, they could go and purchase or hire one from a private firm.

Mr. Lupton thought the idea was that the Corporation had surplus power and that they could utilise it in that way.

The chairman said he would like to put in a protest. The Corporation were going beyond what they ought to do.

Mr. Wicksteed said that, seeing the Corporation had taken over the supply of electricity, he supposed they ought to supply motors suitable for the current.

Mr. Wardle did not think so. He expressed the view that, under municipal management they paid about 40 per cent. too much for gas. The same quantity of gas was made in Sheffield under a company for nearly £100,000 less than was paid in Leeds. The tramways would be very much better managed if they were leased to a company. He contended that municipal trading was nearly always bad, for they got such a large number of employés who did not earn their wages for the most part. It was absolutely a scandal; in many municipal undertakings men were pitchforked into jobs because they were voters, and they did not earn their wages. The managers of the Corporation did not treat them as a private employer would.

Conversation ensued as to the number of makers of motors in Leeds, and it was said there were four.

In reply to Mr. Wicksteed, who asked if he suggested that a municipal official would not buy as efficiently as a private user, Mr. Wardle said that as a rule business was badly done by an official, although he did not say that would be the case in this instance.

Ultimately, Mr. Wardle agreed to a suggestion that he should give formal notice of a motion to protest against the proposal of the Corporation.

Newcastle Exhibition.—Mr. W. R. Potter, of Messrs. Potter, Thomas & Co., Newcastle-on-Tyne, writes as follows (too late for our "Correspondence" columns):—"As a reader of your valuable paper, I was greatly interested in reading the report of the Electrical Exhibition recently held in Newcastle, more especially your remarks with reference to the exhibit of the working electrical laundry, by the Provincial Laundries, Ltd., Newcastle; to those who had not the pleasure of inspecting these machines, your remarks imply that the entire running and the *heating* of the various machines was carried out solely by means of electricity. It may interest you to know that these machines were driven by means of overhead shafting, which in turn was driven by a motor, and the heating of the various polishing and collar-shaping

machines was entirely carried out by means of gas, which was most ingeniously laid on, and I think great credit is due to our friends in the gas industry when they can produce such machines heated in this manner. . . . I am only afraid that the thousands who saw this exhibit went away with the idea that the whole process of ironing and heating of the machines was carried out by means of electricity, no doubt owing to the fact that a large display of electrical ironing took place next to the barrier.

A Solar Heat Engine in Egypt.—The Shuman solar heat engine, in a much improved form, is being experimented with at a place near Cairo; the installation is expected to develop about 100 H.P. from the sun's radiant heat.

Locating Icebergs. — Dr. M. Coplans, of Leeds University, has gone to America in order to carry out experiments with a new system for locating icebergs. He will proceed to the ice-zone in a United States cruiser. His system depends upon variations in the electrical conductivity of sea water, on the ground that the presence of icebergs sensibly influences this conductivity over a wide area.

Alleged Long-Firm Frauds.—According to the *Standard*, the following men were charged at Old Street Police Court last week, with fraudulently obtaining large quantities of goods from persons in different parts of the country:—James Winslow, otherwise Darton, aged 39, of Lockinge House, Stafford Street, Swindon, Wiltshire; Frederick Carrier (otherwise Darton), 37, of Broad Street, Swindon: and Frank Horace Hepden, or Hampton, of Hill Side, Dencombe Hill, Forest Hill. "Mr. Sefton Cohen (for the Public Prosecutor) said that it had been deemed necessary to enter against the prisoners further charges of conspiracy to obtain, and of obtaining, by false pretences goods from various firms in London and the provinces. The prisoners Winslow and Carrier had, it seemed, started offices in premises at 3, City Road, at a rental of £60 per annum. They traded in the name of Darton & Co., as shippers and agents, and it was an element of the case that the name of Darton & Co. was assumed because there was a well-known firm of that name for whom they might be mistaken. The offices were kept open until the June quarter, when a distress for rent was put in, and they then left. During the period of their occupancy goods of a most varied character were obtained on credit, by means which, the prosecution suggested, were those known as long-firm proceedings, *i.e.*, the giving of references between themselves, and from one to another as different firms. Thus the name 'Anderson & Co.,' Aldersgate Street, was Darton under another name; and 'Rey & Co.,' of Town Hall Chambers, Old Street, was another; 'F. Hampton & Co.,' of Lower Thames Street, a third, and so on. Goods had been supplied to Darton & Co. and F. Hampton by their using one another as references. The Hoffman Manufacturing Co., of Chelmsford, had been, it was alleged, defrauded of ball-bearings to the value of £30, counsel proceeded. Messrs. Ward & Goldstone, electrical engineers, of Salford, had on four occasions supplied goods to 'F. Hampton' to the amount of £19 odd. The same firm had also supplied goods to Darton & Co., on a reference to Hampton, and in the autumn of last year had been victimised by a firm calling itself Coates & Co., of Chiswell Street, with which the prisoner Hepden would be identified, and the latter, as Hampton, would be shown to have obtained insect powder from Messrs. Keating, of the Borough, to the value of £10, and there the name of a fresh firm, called Beck & Cahill, of Eltham, Kent, was used as a reference. When County Court proceedings were resorted to by Messrs. Keating, and judgment was obtained, a bill of sale was notified as barring all execution on any goods of Hampton & Co. The prisoners were then further remanded, bail being allowed."

North-Eastern Counties Electrical Exhibition.—The second North-Eastern Counties Electrical Exhibition at Newcastle-on-Tyne was brought to a finish on Saturday night, September 28th, after a most successful run. From every point of view, the exhibition has proved a complete success, and, from start to finish, has been most popular, as is proved by the fact that no fewer than 150,000 persons visited it in the three weeks it was open. Financially, too, it has realised more than the highest expectations. On Saturday evening a pleasing presentation was made to Mr. L. E. Buckell, the lighting engineer of the Newcastle Electric Supply Co., who was on the advisory board, and Mr. W. Peacock, the organising manager and secretary. The presentation had been arranged by the exhibitors, in recognition of their indebtedness to these two gentlemen, and subscriptions were speedily forthcoming. Mr. Alan G. Robson, of the Simplex Conduits, Ltd., handed over to Mr. Buckell a gold chronometer, and Mr. Robert Robson, of the Electrical Contractors' Association, handed to Mr. Peacock a silver cigarette case, cream jug and sugar basin. In view of the success that has attended the exhibition, it is proposed to hold an "Ideal Home" exhibition next Easter.

The 25 Club.—We learn from Mr. J. G. Lorrain, the hon. secretary, that the next dinner of the above club will be held at the Waldorf Hotel, Aldwych, on Wednesday, October 30th, at 7.15 for 7.30 o'clock.

Appointments Vacant.—Chief assistant electrical engineer, for the Barking U.D.C. (£130); shift engineer, for the City of Dublin Electricity Supply Committee (£130); assistant electrical engineer, for the Shipley U.D.C.; clerk, for the Swindon Corporation Electricity and Tramway Departments (£80). See our advertisement pages to-day.

Educational.—South-Western Polytechnic Institute, Chelsea.—The day courses in electrical engineering commenced on September 30th; particulars are given in the prospectus for the session 1912-13. Mr. A. J. Makower, M.A., is head of the department, and preparation is given for the degree in Engineering of the University of London. The Institute has its own electricity supply plant, and a large equipment of electrical machines and apparatus for experimental work. Evening courses are also conducted in connection with the department.

The Polytechnic.—The session for 1912-13 commenced on September 30th; courses are provided in electricity and electrical engineering, Mr. W. Hibbert being the head of the department. Lectures are given in telegraphy and telephony by members of the engineering staff of the G.P.O., and a special course on illuminating engineering will be begun on October 25th.

Edinburgh University.—Under the new scheme for engineering degrees the full resources of the University and the Heriot-Watt College are now to be utilised, to enable students to specialise in the departments of civil, mechanical and electrical engineering.

University College, London. — A course of post-graduate lectures will be delivered by Prof. J. A. Fleming, F.R.S., on "Electromagnetic Waves and the Theory of Electrons," commencing on November 6th. The course will comprise six or seven lectures, and is preliminary to a course on "Radiotelegraphy" in the following term. Particulars can be obtained from the secretary.

Fatality.—An inquest was held at Westminster on Monday into the death of Robert Revell, aged 47, who was found lying at the foot of a step-ladder which, it appeared, he had been using for the purpose of changing the carbons of an arc lamp at a Bloomsbury garage. The medical evidence showed that there was no sign of an electric shock, but according to the *Times* the jury found that death was due to a fall from a ladder, but they were unable to say whether an electric shock or drink was the cause.

Institution and Lecture Notes.—Mr. Alfred Hands, M.I.E.E., F.R.Met.S., has entered into arrangements for the delivery of lectures on "Thunder and Lightning," illustrated by lantern slides and experiments, during the first half of the 1912-13 season, before literary and philosophical societies, and in public halls in different parts of the kingdom, including towns in Scotland, Lancashire, Yorkshire, the Midlands, north, south and west London, and so on. We have before us a copy of the synopsis of the lectures, from which we gather that the lecturer, as the result of his long specialised study of the subject, should be able to impart to his audiences a great store of educative and interesting information.

East of Scotland A.M.E.E.—At a meeting of the branch at Dunfermline on Friday last, the President (Mr. C. A. Carlow, Leven) congratulated the members on the large accession to the membership, and announced his intention of awarding a handsome prize for the best paper received during the session. The following dates were provisionally fixed for the session's meetings: Edinburgh, October 26th (open meeting); Dunfermline, November 22nd; Kirkcaldy, December 20th; Dunfermline, January 24th, 1913; Edinburgh, February 22nd; Dunfermline, March 28th; Kirkcaldy, April 25th; and Dunfermline, May 16th.

Mr. Carlow followed with a presidential address, in which he outlined reasons for the increased price of coal since 1896. The three most important reasons he adduced were: (1) More complete organisation of labour; (2) the carrying-on of mining operations at greater depths and in less advantageous circumstances, and (3) the effect of recent legislation. Under the third heading, the speaker observed that in May, 1911, the amended special rules came into force, putting further restrictions on the use of electricity in mines. This means of transmitting power was one of the best friends of the coal industry, and anyone familiar with the subject knew the extra cost due to the establishment of these rules.

The Association of Mining Electrical Engineers held the annual meeting at Sheffield last week.

The Newcastle Conversazione Abandoned.—We regret to learn from our Newcastle correspondent that the Conversazione of Scientific Societies, to which we referred in our last issue, had to be abandoned "owing to local societies of civil, mining, mechanical and electrical engineers not replying in time to permit of arrangements being made." With so excellent a programme as that which we printed in our last issue, there seemed to be every prospect of a most successful gathering.

Electricity for Stoutness.—The *Standard* reports that a London specialist has introduced to the notice of the medical profession a new electrical treatment for stoutness. The main point in the new treatment is the exercising of most of the large muscles of the body under the influence of electricity to an extent that cannot be obtained by ordinary physical methods, such as walking. When certain applications of an electrical current are made to the trunk or limbs, local contractions of muscles frequently occur. Patients being treated for stoutness by this system have to sit in reclining chairs whilst electricity is applied through a number of metal plates which are brought into contact with the skin at various points. The results are said to be both successful and rapid.

Business Announcement.—With regard to our notices regarding the affairs of Mr. A. Martin, trading as the Midland Electrical Supply Co., of Birmingham, the Midland Electric Manufacturing Co., Ltd., of Stafford Works, Rea Street South, Birmingham, write pointing out that their company is in no way connected with the concern referred to, and has never been in any way associated with the same.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The staff of the York Corporation electricity department have presented a clock to Mr. Herbert Foster, who is leaving to take up an appointment with the Electrical Co., Ltd., of London.

Mr. W. M. Milnes, assistant electrical engineer to the Burnley Corporation, having obtained another appointment at Coventry, Mr. T. Taylor has been appointed assistant engineer, and Mr. H. Leaver, of Middlesbrough, has been selected to fill the position of senior assistant engineer.

Mr. E. B. Thornhill has been appointed borough electrical engineer at Limerick, in succession to Mr. Grainger, who resigned that appointment.

Mr. W. W. Parkinson, the works manager of Blackpool Corporation electricity department, was married to Miss Gertrude Robson, eldest daughter of the late Mr. Fredk. Robson, of St. James's Road, South Shore, at the Wesleyan Church, at Ansdell, on Friday last.

Mr. F. C. Hodge, of Stretford, has been appointed to the position of installation foreman recently advertised by the Salford Corporation electricity department.

Mr. Albert Spencer-Wells, of the Wellingborough Electric Supply Co., Ltd., and formerly of Stratford-on-Avon and Cheltenham, has joined Messrs. Callender's staff at Bombay.

Tramway Officials.—A large gathering of the officials and employés of the Hull Corporation tramway electrical engineer's department took place at the tramway power station on Saturday evening, to bid farewell to Mr. W. T. Robson, who is leaving to take up the position of general manager of the South Shields Corporation tramways. Mr. J. Wilkinson, the tramway electrical engineer, referred briefly to the 12 years which Mr. Robson had spent as an official in the department, and said that Mr. Robson had gained the esteem of all with whom he had come in contact, and especially of the men over whom he had had control. He wished him on behalf of all present every good fortune in his new undertaking. On behalf of the staff and employés, Mr. Wilkinson asked Mr. Robson to accept with the best wishes of all those present, a gold lever watch. Mr. Robson responded in suitable terms.

Mr. L. E. Harvey, tramways manager at South Shields, who is leaving to take up a similar appointment at Ilford, has been presented by the staff and employés with a hall clock and photograph of the subscribers, and by the shed men and office staff with a leather suit case.

Mr. Edmed, permanent way engineer on the Maidstone Corporation tramways, who is leaving to take up a similar position at Dartford, has been presented by the tramway employés with a case of pipes and a silver-mounted walking stick.

Mr. Frank Buckley, the newly-appointed manager of the Wigan Corporation tramways, has been presented by the Salford Tramway staff with a silver flower stand as a farewell gift.

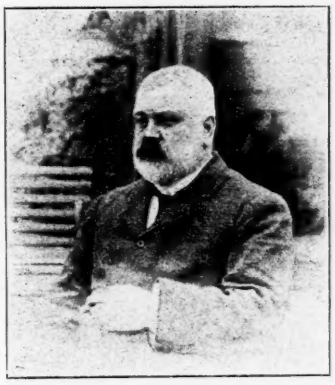
General.—Mr. E. H. Owen, who is shortly severing his connection with the Diesel Engine Co., intends to devote his extensive knowledge and experience of high-compression engines to a new development in Diesel type motors.

The *Times* announces that the Postmaster-General has appointed Mr. L. A. Marshall, I.S.O., to be Assistant Secretary to the Post Office.

At the annual meeting of the Govan Unionist Association, satisfaction was expressed over the fact that Mr. George Balfour would again contest the constituency. In the course of the proceedings a letter was read from Sir Geo. Younger, the Scottish Unionist Whip, congratulating the Unionists of Govan on having again secured Mr. Geo. Balfour as candidate.

Mr. M. I. Williams-Ellis left England last week for South Africa, in connection with electrical work on the Rand.

Obituary.—Mr. Duncan McNaught.—We regret to announce the death of Mr. Duncan McNaught, resident engineer to the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., who passed away on Monday, September 23rd, at the age of 56, after a brief illness resulting from internal complications. Mr. McNaught entered the company's service some 25 years ago, and in spite of his strenuous work in connection with his important position, was at all times of a congenial disposition and interested himself considerably in various local events, especially athletics. He was likewise a keen yachtsman. This pastime always had a fascination for him, and he enjoyed it at every favourable opportunity. He was a son of the late William McNaught, of Glasgow, and Manchester, the inventor of the McNaught compound beam engine, and his grandfather was the inventor of the well-known McNaught indicator. The interment took place at East Ham Parish Churchyard on Saturday last. The *cortège* was attended by the following mourners:—Mr. Robert McNaught (brother), Mr. Stuart A. Russell (works manager), Capt. Benest (submarine cable department), Mr. W. Best (electric light department), Dr. Brews, J.P. (his medical attendant), Messrs. W. D. Blair, H. B. Robinson, T. H. Ivey, F. T. Laws and H. E. Westhorp (engineering department), R. Stables and A. Cheetham (india-rubber department), G. Stoat (ebonite department), E. Wolfe (electrical cables department), Geo. K. Willsher (general offices), also Messrs. T. W. Dickson, T. Ginman, C. Brown, J. Gemmell, C. Rush, H. Nelson, W. Cosh, H. Wolfe, H. Towlson, F. Pattinson, M. Williams, E. Barnard, W. Robinson, D. Anderson, J. W. Pearson, A. Collier, Williams and Gamblin. Amongst the numerous company assembled in the church and at the graveside was Mr. Christian H. Gray (one of the company's directors). The floral tributes, which were very numerous, included those sent by the engineering department staff, workmen of the engineering department, the india-rubber and tire-making staff, Charlton Conservative Club, Mr. Stuart A. Russell, india-rubber works athletic club, proofing department, Mr. C. H. Gray, Mr. M. H. Gray, "Graysilver Band," and a beautiful artificial wreath from the members of the works fire brigade, of which Mr. McNaught was captain.



The Late Mr. Duncan McNaught.

CITY NOTES.

Quebec Railway Light, Heat and Power Co., Ltd.

The directors' report for the year ended June 30th, 1912, which was submitted at the annual meeting held at Montreal on September 10th, showed that the gross earnings from operation for the year were $1,415,825, as compared with $1,280,127 in 1911, an increase of $135,698. The operating expenses were $734,925, as compared with $661,907, an increase of $73,018. The net earnings were $680,900, an increase of $62,680 over 1911, equal to 10·13 per cent. After adding miscellaneous income of $194,584, and deducting fixed charges of $660,364, dividends paid October 15th, 1911, and January 15th, 1912, amounting to $199,990, and organisation expenses of $3,920, there remains a net surplus of $11,211, which added to the surplus account leaves a balance of $73,539 to the credit of this account. Reserve accounts have also been created. The work of the consolidation under the direction of Mr. R. S. Kelsch, consulting engineer, of the various power supplies at the Queen Street sub-station has been completed and is a great advantage both to the customers of the company and the company itself, guaranteeing as it does a service free from interruptions or breakdowns, the company being able to utilise power from any one or all of its hydraulic stations, and its steam plant for its various lighting or power requirements. Special attention has been paid during the year to the distribution system, and a large sum has been expended in repairs and replacements. Several important power contracts are in view for the coming year and the outlook is bright. The increase in gross earnings from operation of $135,698 demonstrates not only the increased growth of the company's business, but also of the city and district served by the company, and it is the opinion of the directors that this increased growth will continue. A feature of the financial report is that while a large sum has been spent by the company upon the upkeep and improvement of its various plants, the percentage of operating expenses to gross earnings remains at the low figure of 51·91 per cent. The completion of the company's new office building at the corner of Crown and St. Joseph Streets was unfortunately delayed until May 1st this year. The completion of the building enables the consolidation of the company's executive offices in the one building, and has facilitated the transaction of the company's business.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ended September 30th.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. for the quarter to September 30th on the ordinary shares.

Helsby Wireless Telegraph Co., Ltd.

Lieut.-Col. J. Bernard (chairman) presided at a meeting of the shareholders of the above company at Lennox House, Norfolk Street, W.C., on Wednesday. The proceedings were purely formal, and on the motion of the chairman the report, from which we make the following extracts, was adopted :—

"Since December 5th last, the date of the last report, the award in the arbitration then referred to has been given, and its terms, although onerous, allow us to continue the development of our wireless telegraph business which we are now actively pursuing. The arbitration was tiresomely prolonged, and the award was not forthcoming until June 11th last. The expenses were considerable, but Messrs. Siemens Bros. & Co., Ltd., very generously supported us not only financially, but by placing their experienced advice and technical experts at our disposal, and, probably, without their assistance we should not have been able to maintain our application against the long-drawn-out opposition to which we were subjected."

"We are advised that the Lodge patent is a master one, and therefore it was impossible to quote prices or seek business until the above award was given, but in the meantime a great deal of preparatory work has been done and the apparatus standardised, and your directors are glad to report that the numerous inquiries reaching them are now being energetically dealt with. Moreover, they are advised that the system, altered and improved, now adopted is quite free from any likelihood of contention as regards patent infringement, &c. The report recently issued by the Merchant Shipping Advisory Committee respecting life-saving appliances and other means of ensuring safety of life at sea refers, *inter alia*, to the evidence given before it by your chairman and by your engineer, and to the work already done by your company. The Committee draw attention to the fact that it is desirable to first establish the conditions of a free market in wireless telegraphy before recommending compulsory usage, so as to obviate the possibility of ship owners being delivered into the hands of a monopoly which could impose such terms as it pleased without stay or hindrance. Your directors believe that this recommendation is greatly in favour of your company's prospects, since, subject to a free market being established, the Committee are of opinion that the installation of wireless telegraphy is a necessity on all foreign-going vessels having on board 50 persons or more, including passengers and crew, and that it is desirable with regard to vessels not carrying passengers that an adequate number of them should be so equipped. This weighty dictum appears to open up a vast field for the operations of your company, which your directors are now ready to take advantage of.

"In the last report the question of tranferring the company's entire commercial management to the British Insulated and Helsby Cables, Ltd., or an associated company, was referred to. Your directors having gone further into the details of the matter, have come to the conclusion that it is preferable to retain the commercial control of the business in the hands of your company, and they have now arrived at an alternative arrangement with the British Insulated and Helsby Cables, Ltd., and the Automatic Telephone Manufacturing Co., Ltd., which they recommend being carried through under an agreement, as being the best possible arrangement for your company, under all the circumstances, and this agreement they are now ready to complete. These altered conditions will, with the vendor shareholders' assent, not prevent the scheme for the reduction of capital from £20,498 to £10,000 being carried through in accordance with the special resolution passed in December last, and confirmed in January. An application to this effect to the Court will be made as early as possible."

"Referring to the accounts . . . . for the reasons already stated . . . . practically no business has been transacted during the year. A considerable reduction has been made in the general charges, and it has been deemed advisable to write down the value of the stock to the lowest possible figure, the depreciation having chiefly arisen through our having to remodel our apparatus, in consequence of the judgment given last year by Mr. Justice Parker, and to conform with the Lodge (Master) Patent under which we are obliged to work. Regarding the large amounts appearing as an asset under the two headings, "Purchase Account" and "Preliminary Expenses," your directors propose to write down the aggregate of these amounts by the amount (£10,498) of the reduced capital following the surrender of the equivalent value of the vendor shares, as soon as that reduction has been effected."

Owing to ill health, Captain Gonne has been obliged to resign his seat on the board. The directors have obtained an acquisition to the board in Mr. Arthur Brooker, a gentleman widely known in the telegraph world, who has been appointed to fill the vacancy.

Prospectus.—*The General Electric Co. (U.S.A.).*—Applications have just been invited for $4,000,000 forty-year 5 per cent. gold debentures in denominations of $500 and $1,000 each to bearer at the price of 99¾ per cent. and accrued interest, which at exchange $4·86 is equivalent to £103 10s. per $500. A simultaneous offer of debentures has been made in the U.S.A. The proceeds are to provide for the rapidly-expanding business of the company, orders received for the current year being at a rate in excess of $90,000,000 per annum against about $70,000,000 in 1911.

Costa Rica Electric Light and Power Co., Ltd.—The annual meeting of this company was held on Wednesday at the offices, Dashwood House, Old Broad Street. A representative of the Electrical Review was informed that the proceedings were private, and a request for a copy of the report was refused.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved :—

Cape Town-Cairo Railway and Telegraph Combination Syndicate, Ltd.
Chorley and District Tramways, Ltd.
De Martis Electric Storage Syndicate, Ltd.
Dual Ignition Co., Ltd.
E.B. Liquid Fuel Burners and Furnaces, Ltd.
Electrical Trolley Head Co., Ltd.
Electric Entertainments Syndicate, Ltd.
Electro-Metallurgical Syndicate, Ltd.
Electric Ordnance Co., Ltd.
Electro Scrip Sign Co., Ltd.
Gravity Flame Arc Lamps, Ltd.
Hart-Durtnall Syndicate, Ltd.
Holmquist Electric Co., Ltd.
Integral Steam Generator Syndicate, Ltd.
Ljungstrom Engine Boiler and Condenser Co., Ltd.
Mersea Motor and Electric Co., Ltd.
Mountain & Gibson & Thornewill, Ltd.
National Radium Trust, Ltd.
Palmer & Co. (Electricians), Ltd.
Perth Traction and Development Co., Ltd.
Pollak-Virag Rapid Telegraph Co., Ltd.
Premier Electric Institute, Ltd.
Technical Press Bureau, Ltd.
Wireless Syndicate, Ltd.

United Electric Tramways Co. of Caracas, Ltd.—The report (as appearing in the *Financier*) states that the profits of the local company (the whole capital of which is owned by this company) for the past year have shown a gratifying increase. The net result is that had the profits of the local company been distributed they would have been sufficient to pay a dividend of over 5 per cent. on this company's capital, in addition to debenture interest and sinking fund, and the usual provision for renewals and reserve. The directors consider this very satisfactory. The operations of the local company (La Compania de Tranvias Electricos de Caracas) are shown as under :—Gross receipts, 1911-12, Bs1,247,405 ; increase, Bs158,424 ; operating expenses, 1911-12, Bs688,610 ; increase, Bs51,572 ; net receipts, 1911-12, Bs558,795 ; increase, Bs96,851 (at an average exchange for the year (25·96) equal to £21,523 ; increase, £3,799). After adding Bs171,030, the balance of profit carried forward from the previous years, providing for the mortgage interest payable to this company—viz., £10,200 (equal to Bs257,550), setting aside Bs50,000 to reserve and renewal funds, and paying a dividend of 5 per cent. on the share capital of Bs636,000, which absorbed Bs31,800, the local company are enabled to carry forward Bs390,476. Notwithstanding an increase in operating expenses, due to the increased traffic, the ratio to gross receipts is less by 2·38 per cent. compared with the previous year. Three new cars which the increasing traffic necessitated have been provided, and are now being put into service, and two new short extensions of the line have been authorised. In compliance with the terms of the trust deed £979 has been placed to the sinking fund for the redemption of mortgage debenture stock, and £1,100 first mortgage debenture stock has been purchased this year in the market and cancelled.

Consolidated Gas, Electric Light and Power Co. of Baltimore.—The report shows (according to the *Times*) that the net earnings for the year ended June 30th amounted to $2,822,399 After deducting fixed charges and dividends paid and payable, and placing $455,526 to reserve for renewals, amortisation, &c., there remains a net surplus of $204,855. The gross income, as compared with the previous year, shows an increase of $597,510, or 12·3 per cent., and the net earnings an increase of $410,063, or 17 per cent. The business of both the gas division and the electric division has continued to expand, the gas output showing an increase of 8 per cent. and the electric output an increase of 43·6 per cent., as compared with the previous year. In order to meet the increasing use of gas and electricity and to anticipate future requirements, expenditures during the year for extensions, improvements and betterments completed and in course of completion amounted to $1,364,703.

Dundee, Broughty Ferry and District Tramway Co., Ltd.—Ex-Provost Brownlee, the chairman, moving the adoption of the directors' report, which recommended payment of a dividend of 2½ per cent. on the ordinary shares, at the annual meeting last week, pointed out that there was an increase in revenue of £735, and an increase in expenditure of £470. The increased receipts were due to the coal strike and the consequent withdrawal of many of the trains. Everything in connection with the company was going quite satisfactorily and the revenue had been fairly good. Mr. George Balfour seconded, and the report was adopted. Messrs. George Balfour and D. W. Wybrants were re-elected directors. Mr. Balfour, in acknowledging, said that recently a scare had got up with regard to motor-'bus competition with tramways, but after a pretty wide experience of tramways and a moderate knowledge of motor-'buses, he thought that no one holding tramway stock in interurban systems need fear motor-'bus competition, even with the most up-to-date 'buses or with future improvement of the 'bus system.

Hove Electric Lighting Co., Ltd.—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 8 per cent. per annum for the six months ended June 30th last. The dividend will be payable on October 15th next.

Madras Electric Tramways (1904), Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the June half-year.

Babcock & Wilcox, Ltd.—The directors announce an interim dividend of 7 per cent. (actual) on the ordinary shares.

Cleveland and Durham Electric Power Co., Ltd.

The sixth ordinary general meeting was held at Newcastle-on-Tyne on September 30th, Mr. James Falconer, M.P., in the chair. There was a large attendance of shareholders.

The Chairman, in moving the adoption of the report (see Electrical Review, page 509), said that the gross profit for the year was £25,784, as against a gross profit of £20,973 last year. In considering the bearing of that on the result of the year, it was necessary to keep in view that during the year covered by the accounts they had a railway and a coal strike. The coal strike cost them £8,000 as a direct loss, and when they took that into account, with the fact that they had still increased their profit by £4,810, he thought the shareholders would agree that there had been a substantial advance in their business. During that strike they had been able to supply their consumers every unit of energy they required. The net profit for the year was £6,720, and with the carry forward there was £15,000 to dispose of. They proposed to write off the discounts on the second debentures (£2,800), and to lay the foundation of a depreciation and renewal fund (£2,000), and to pay 2 per cent. on the preference shares which came to £6,674 ; that left £3,589 to carry forward to the next account. With regard to the position of the company's business, he would like to say a few words. As the shareholders knew, that company —the Cleveland Limited Co.—was formed to acquire shares in the Cleveland Parliamentary Co., which owned statutory powers over a wide area, and to develop it. In that company were held the whole of the shares. They also owned the controlling interest in another company, called the Northern Counties Co., which supplied the power for certain other areas. Now, the best method of testing the advance of the company's business was to take the results of the Limited Co. and of the Parliamentary Co. and of the Northern Counties Co. together. Taking the gross profit for the year of the three companies, these amounted to £34,153, an increase over last year of £8,932. In the preceding three years, they were in 1909-10 £20,000, in 1910-11 £26,000, and as they had just heard in 1911-12, £34,153. It had also to be borne in mind that their capital charges had been increasing, because they had been spending more money and had had to pay more money for these three years. The charges for interest were as follow :—In 1909, £17,629 ; 1910-11, £19,598 ; and 1911-12, £25,571 ; and the balances in these three respective years were £2,500, £6,423 and £8,500. If they took another test, that of the amount of horse-power connected, which was a real indication of the business which they had secured, the figures for the year which they had now reached was 48,429 H.P. connected, as against 40,460 H.P. on June 30th, 1911, an increase of substantially 20 per cent. As regarded the immediate future, they had at the present time contracts arranged to the extent of 11,000 H.P., so that the volume of business which the company might look forward to doing showed a steady substantial increase. He thought they would agree that there had been a real substantial progress in the development of the business of the company. He added that it was the board's opinion and his own, that there was good reason for the shareholders having confidence in the company. That opinion was based on these considerations. They had an exceptionally fine field for the supply of power, and they had the best system of generation of any company, owing to the fact that they had in their area of supply a very large volume of waste heat which they had been able to utilise for manufacturing electricity. From the point of reliability and economy their company would compare favourably with any company of which he was aware. They had laid down a very comprehensive system of distribution, so that they were able to deal with a very large increase in the volume of their business without any great expenditure on their system of distribution. So far as the directors were concerned, they had confidence in the undertaking. As to the time in which success would be fully attained, that was a question which very much depended on the consumers, fluctuations might occur that were beyond their control, yet, if their progress was maintained, as there was every reason to believe it would be maintained, they were approaching a time when there would be a return for the capital in the undertaking. The chairman then went on to refer to a circular that had been sent out by Mr. Gemmell. The questions raised in that circular, he said, were old questions, but at the same time shareholders who did not know the facts might think there was something in the charges which were made apparently against the board. The first point Mr. Gemmell raised was as to the arrangement between that company and the Waste Heat Co. So far as the interests of their company were concerned, he did not know that there was anything that was more satisfactory than that arrangement. They had been able to get a supply of power on much more favourable terms than any other company was able to manufacture it. On what grounds Mr. Gemmell could suggest that this waste heat agreement was against the interests of their company he could not possibly understand. It was suggested that it was not within the powers of the company. It was not only within the powers of the company, but it was the absolute duty of the board to provide the cheapest current they could, and this they had done in making this agreement. The next point Mr. Gemmell dealt with was the question with regard to what he called "fictitious profits" as between the Limited Co. and the Parliamentary Co. In this regard Mr. Gemmell was under a delusion. There was nothing of the kind in the accounts. The chairman went further into Mr. Gemmell's statements at considerable length.

Mr. Gemmell said he did not doubt that the directors had done their best, but they could not shut their eyes to the fact that they had produced very poor results in the last six years. He regretted that he was unable to accept the chairman's statement as a proper interpretation of the position of affairs. It was not a satisfactory explanation of past irregularities, and it was not an adequate reply to the charges made against the directors. The shareholders were not getting fair play. They were not getting out of this business what they as shareholders were entitled to. There ought to have been a dividend for both preference and ordinary shareholders. They were not getting half the profits that were estimated in the prospectus without waste heat. After further remarks, Mr. Gemmell moved an amendment postponing the adoption of the report, and appointing a committee of investigation.

Mrs. Gemmell seconded the amendment, and on the Chairman putting it, he declared that the mover and seconder alone voted for it.

The report was then adopted by a large majority.

The election of Mr. C. P. F. Pierret as a director was confirmed, and Mr. Philip E. Noble was re-elected.

Mr. William Swan, the retiring auditor, was then re-elected, an amendment moved by Mr. Gemmell that Messrs. Strachan & Co. and Messrs. Peat & Co. be appointed being defeated, only Mr. and Mrs. Gemmell supporting it.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List :—

Madras Electric Tramways (1904), Ltd.—11,500 6 per cent. cumulative preference shares of £5 each, fully paid (Nos. 1 to 11,500).

The Committee have appointed special settling days as under :—

Wednesday, October 16th.—General Electric Co., Ltd.—Further issue of 15,000 6 per cent. cumulative preference shares of £10 each, fully and partly (£6) paid (Nos. 25,001 to 40,000) (provisional certificates).

Thursday, October 17th.—Buenos Ayres Lacroze Tramways Co.—Scrip, fully and partly paid, for £500,000 5 per cent. consolidated mortgage debentures.

And ordered the undermentioned securities to be quoted in the Official List :—

Buenos Ayres Lacroze Tramways Co.—Scrip, partly paid, for £500,000 5 per cent. consolidated mortgage debentures.

General Electric Co., Ltd.—Further issue of 15,000 6 per cent. cumulative preference shares of £10 each, £6 paid (Nos. 25,001 to 40,000) (provisional certificates).

Ruston, Proctor & Co., Ltd.—Further issue of 150,000 ordinary shares of £1 each, fully paid (Nos. 350,001 to 500,000).

Sunderland District Electric Tramways, Ltd.—According to the *Financier*, the report states that the accounts for the year to October 31st, 1911, after providing for interest on prior lien bonds and debentures, show a loss of £688, increasing the debit balance of revenue account to £16,890. The meeting was called for yesterday.

Lisbon Electric Tramways Co., Ltd.—The directors have announced an interim dividend of 3 per cent., free of tax, payable on November 1st.

Metropolitan Electric Tramways, Ltd.—The directors have declared an interim dividend of 2½ per cent. (6d. per share), less income-tax, on the ordinary shares.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1¼ per cent.

STOCKS AND SHARES.

Tuesday Evening.

Foreign politics have overhung Stock Exchange markets very darkly this week. Once more it is the Balkans which is the centre of the disturbances, and with the newspapers' contents bills full of gloomy—not to say sensational—suggestions, it is not surprising that neither investor nor speculator cares to venture far into fresh avenues of financial enterprise. So far as price movements in our lists are concerned, the most marked are those in Sao Paulo Trams and Rio Trams. There is also considerable business going on still in the Underground Railway group.

City and South London Ordinary stock, after touching 46, subsided to 42 on the delay in the expected announcement that the line was going to be taken over by the Midland Railway on the basis of a 2½ per cent. guaranteed dividend. On the face of it, the rumour did not look probable, but it served its purpose ; and perhaps, on the theory that where there is smoke there is fire, there may be something in the idea that one of the bigger companies is angling for control of the oldest tube in London. The company's four Preference stocks have all moved up to the extent of a point each. Central London Ordinary, after rising 3 to 81, eased off to 79, and here also the rumour-mongers are very busy with the suggestion that the Great Western, this time, is seeking to obtain the Central London for its own by the promise of a guaranteed dividend variously estimated between 4 and 4½ per cent. It has of late become so fashionable to connect one tube railway with sometimes several of the bigger lines that any statement is eagerly snapped up, and prices are advanced without much regard to the inherent likelihood of the rumours proving correct. Metropolitan Consolidated fell back 2½ in Tuesday's slump, and Districts shed a point. There is no change in Great Northern and City Preferred, and East Londons keep steady at 9⅛.

London United Tramways Preference are 25s. up to 5⅞, and the Debenture stock at 74 is a point higher, on whispers that important negotiations are afoot with a view to bringing this company more

closely into the tube and 'bus combine. There is never much market in either class of the London United Company's issues, so it takes little to move the prices quite sharply. Moreover, the progressive results achieved by the Metropolitan Electric Tramways had their sympathetic effect, while the tramway shares themselves spurted ⅛, the Deferred rising ⅜ on the good figures printed in the report. British Electric Tractions are a little better. Isle of Thanet 4 per cent. Debenture rose 2. While the railway market is influenced largely by the depression brought about by the Balkans affair, the Tramways section is able to pursue a line of its own, and no particular notice is taken of the happenings abroad.

English Electricity Supply shares continue to show decided strength. In the London division the feature is the strength of Brompton Ordinary and Preference, the former rising 10s., and the latter 1s. 8d. Cities are the turn easier at 18 middle. Metropolitans, however, are ⅛ down. Oxfords recovered part of the dividend deducted, and show a rise of 5s.; while the other movements are mainly the result of *ex*-dividend markings, some of the deductions being partially recovered by now.

It has already been mentioned that Sao Paulo Trams are particularly strong, and the net result is a rise in the shares to 285, being about 17 points higher on the week. There is, of course, a comparatively narrow market in the shares, and statements are in the air amalgamating this company with one or two others; although, at the same time, it is declared that the rise in the price is justified on the earnings of the company, which certainly show remarkable expansion, and point to a possible increase in the dividend before long. Rio trams are 5½ higher, following upon their rise of 4 last week. Shawinigan Water stock has eased off 2 points nominally, but this is due to the fact of the stock being quoted *ex* rights. British Columbia Electric Railway Deferred shows a rise of 2, and the whole of the Latin-Canadian market displays strength. There has been a recovery in various Mexican issues, the news from the country being read as rather less disquieting than it was a week ago. Calcutta Trams are good, putting on ½, and Cordoba Light and Power Ordinary hardened to 18s. 9d. middle.

In the Telegraph market, the firmness of the Anglo-American group is again noticeable, though there are no quotable changes in the prices of Anglo-American stocks. American Telephone and Telegraphs lost their 2 points rise of last week. The recovery in West India and Panama Ordinary and First Preference was hailed as an indication that the buyers from over the water are taking an interest again in the shares, but perhaps it would be well not to build too much upon this assertion at the moment, for the Americans are very busy engineering their autumn boom in Rails, in the teeth of the excitement and unsettlement produced by the forthcoming presidential election. Moreover, the anti-trustites are on the war-path again, and money is dear in New York.

Globe Telegraph Trust Ordinary and Preference both recovered the dividends taken off the prices last Friday. Oriental Telephones are 1/16 higher, and so are United River Plate Telephones. Reuters, on the declaration of a substantial increase in the dividend, moved up 17s. 6d. to 11⅞ middle. The Marconi market has been flat. Added to the plain hint of possible competition, there is the unfortunate accident to the renowned inventor which has involved the question of his eyesight; and although everybody is thankful to hear the physicians say they hope that Mr. Marconi's eyesight will not be impaired, the mere apprehension of such a thing served to depress the market materially. A recovery has ensued from the lowest prices touched, but various parts of the group—American, Canadian and Spanish—participated in the dulness shown by the shares of the parent company.

Manufacturing issues are, on the whole, very firm. Babcocks at 3 5/16 are 1/16 better, though Dick, Kerrs have given way slightly. Several of the Debenture stocks are in demand, and in some cases there is not sufficient supply to meet it. In the Rubber market the prices of shares have followed that of the raw material, which has been sagging. Conflicting views are expressed by people who ought to know as to what the future of the raw rubber market is likely to hold, and those who contend that there will be a shortage of the product before Christmas stick to their guns in spite of the apparent apathy shown by large users of raw rubber.

The additions made to our dividend columns, to which we drew attention last week, have already proved useful, if we may judge from several remarks which have reached us. At the risk of wearying by reiteration, may we repeat that, in most cases, it is essential to work out the yields on the basis of the last dividends paid; but where this would be obviously misleading, we have left the space blank in the final column. For example: General Electric Preference shares, of course, now carry a 6 per cent. dividend, but this distribution will not start until the new year. There are a few instances of somewhat similar sort which have to be treated in this way; and, as we observed last week, it will be regarded as a kindness if readers will take the trouble to point out what mistakes and omissions may have eluded the endeavour to get the lists exactly correct.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers, during the five weeks ended August 30th, 1912, amounted to 1,403,438, compared with 1,228,805 units in the corresponding five weeks in 1911.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for interest on the 4½ per cent. first mortgage debenture stock, for the six months ended 1st inst., were posted some days ago.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Sept. 25	3,215	+ 127	17	27,763	— 48	14·4	..
Ayr	„ 28	970	+ 21	19	8,628	+ 142	8	..
Bath	..	..	..	..	..	..	..	..
Birkenhead	..	..	..	..	..	..	..	..
Birmingham Corp.	„ 21	21,453	+3,340	25	264,4?3	+59,861	57·17	..
Blackburn	„ 25	2,507	+ 155	26⅞	31,953	+ 205	14·62	..
Blackpool Corp.	„ 26	4,908	+ 595	..	..	..	11·87	..
Blackpool-Fleetw'd	„ 28	2,364	+ 244	12	20,830	— 777	8	..
Bournemouth	„ 25	4,327	+ 315	25⅔	52,402	+ 1,425	21·95	..
Bradford	„ 21	11,183	+ 263	25	141,105	— 2,098	56	..
Brighton	„ 29	2,136	— 45	26	29,860	— 1,120	9·5	..
Bristol	„ 27	15,029	+2,088	..	271,198	+20,819	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 20	648	+ 177	38	11,304	+ 3,018	3·65	..
Barnsley	„ 20	392	+ 6	„	6,745	— 270	..	..
Barrow	„ 20	806	+ 68	„	14,743	+ 2,948	5·37	..
Devonport	„ 20	1,155	+ 73	„	20,573	+ 1,561	8·85	..
Gateshead	„ 20	2,197	+ 65	„	39,348	— 100	11·25	..
Gravesend	„ 20	460	— 12	„	7,973	— 227	6·5	..
Greenock	„ 20	1,733	+ 150	„	30,968	+ 3,191	7·25	..
Kidderminster	„ 20	252	— 5	„	4,6 7	+ 21	..	..
‡Leamington	„ 20	431	— 3	„	7,316	+ 333	..	..
Merthyr	„ 20	446	— 3	„	7,613	— 403	2·9	..
Metropolitan	„ 20	17,602	—1,026	„	335,619	— 500	22	..
Middleton	„ 20	675	— 19	„	12,829	— 429	8·5	..
Mid. Joint Com'tee	„ 20	6,902	+ 392	„	124,046	+ 5,718	..	..
Oldham—Ashton	„ 20	1,261	+ 84	„	23,254	+ 1,888	9·13	..
Peterborough	„ 20	274	— 1	„	5,254	+ 311	5·31	..
Potteries	„ 20	4,178	+ 111	„	71,801	— 1,266	29	..
Rothesay	„ 20	596	+ 45	„	9,693	— 83	2·75	..
Southport	„ 20	683	+ 22	„	11,733	— 307	8·17	..
S. Metropolitan	„ 20	1,737	— 88	„	32,613	— 1,015	..	..
Swansea	„ 20	2,417	+ 12	„	43,916	+ 65	19·5	..
Tynemouth	„ 20	586	— 18	„	9,901	— 993	3·75	..
Weston-s-Mare	„ 20	500	— 90	„	6,264	— 1,308	3	..
‡Worcester	„ 20	648	— 65	„	11,388	— 141	5·75	..
Wrexham	„ 20	251	+ 22	„	4,3?6	+ 506	..	..
Yorks. Wool. Dist.	„ 20	2,269	+ 85	„	41,153	+ 963	17	..
Miscellaneous	„ 20	..	..	„	..	..	..	..
Burnley	„ 28	3,185	+ 476	..	..	..	12·44	..
Burton-on-Trent	„ 29	529	— 25	26	7,172	— 433	6·6	..
Bury	„ 22	2,745	+ 215	25	33,258	+ 685	22·5	..
Cardiff	„ 21	5,085	+ 224	25	61,889	— 2,665	17·35	..
Chatham and Dist.	„ 26	1,806	+ 3	39	33,476	— 308	14·98	..
Cork	„ 26	992	— 6	39	18,938	— 907	9·89	..
Croydon	„ 20	3,551	— 60	24	46,308	— 1,257	11·6	..
Darlington	„ 28	435	— 12	26	5,875	+ 30	4·87	..
Darwen	„ 27	547	+ 24	26	7,346	+ 155	4·86	..
Dover	„ 21	512	— 87	25	6,735	— 556	4·73	..
Dublin	„ 27	11,450	+ 440	..	77,940	— 9,417	54·25	..
East Ham	„ 28	2,115	— 66	26	27,921	— 479	7·87	..
Exeter	..	..	..	..	..	..	..	..
Glasgow	„ 28	39,540	—1,750	..	319,896	— 6,?76	98	..
Hastings	„ 30	2,523	— 43	..	..	— 2,4?8	19·3	..
Hull	„ 28	5,835	+ 203	26	75,524	+ 730	13·5	—1
†Ilkeston	„ 25	122	— 8	26	2,867	— 675	..	..
†Ipswich	„ 21	482	— 4	25	12,070	— 233	10·5	..
†Kilmarnock	„ 21	169	+ 8	18	3,112	— 219	4·25	..
Lancashire United	„ 25	2,954	+ 209	39	52,488	— 315	39	..
Leeds	„ 28	16,097	+ 913	26	204,612	+ 6,199	112·7	..
Leicester	„ 28	5,314	+ 262	39	99,216	+ 2,934	20	..
Leith	„ 28	1,384	+ 88	192	13,971	+ 157	8·72	..
Liverpool	„ 21	28,870	+ 604	37½	453,834	+20,058	117	1
‡L.C.C.	„ 18	80,158	—6,855	..	1,042,349	—55,849	141·1	—·5
London United	„ 28	12,679	— 632	..	248,318	—13,?25	..	..
†Lowestoft	„ 28	209	— 20	52	10,728	— 9?7	3·5	..
Manchester	„ 28	34,194	+1,757	26	488 952	+14,804	105	..
Newcastle	„ 28	8,825	+ 434	..	113,849	+ 1,147	31·3	..
Newport	„ 21	1,428	+ 56	25	17,801	— 695	7·25	..
Oldham	„ 29	4,116	+ 256	27	56,016	+ 2,992	28	..
Pontypridd	„ 28	855	+ 40	26	10,185	— 705	5·5	..
Portsmouth	..	..	..	..	..	..	15·75	..
Preston	„ 25	1,602	— 39	26	21,953	+ 958	10	..
Rotherham	„ 25	1,545	+ 184	25⅔	18,726	+ 1,170	12	..
Salford	„ 30	10 033	+ 193	26	132,990	+ 2,925	41	..
Sheffield	Oct. 1	18,609	+ 792	..	178,611	+ 6,215	40	..
Southampton	Sept. 25	2,591	— 38	25	33,487	— 155	11	..
Southend-on-Sea	„ 25	1,818	+ 124	26	23,681	+ 2,247	7	..
†South Shields	„ 21	684	+ 93	25	16,252	— 189	10·25	..
Tyneside	„ 25	1,075	+ 126	13	6,452	— 769	11	..
Wallasey	„ 28	2,196	+ 19	25⅔	30,359	— 466	8·72	..
Walthamstow	„ 28	1,431	— 13	26	20,223	— 849	9	..
West Ham	„ 19	5,111	— 332	24⅓	65,912	— 2,?47	16·45	1·2
Wolverhampton	„ 25	2,025	+ 88	26	26,463	+ 337	13·75	..
Cen. London Rly.	„ 28	9,687	+ 163	13	57,439	+ 597	6·78	·5
City & S. Lon. Rly.	„ 29	5 671	— 663	13	36 955	— 2,976	7·26	..
Dublin-Lucan Rly.	„ 27	334	+ 2	13	2,124	— 137	7	..
G.N. and City Rly.	„ 28	2,687	— 88	13	17,817	— 40	3·5	..
L'pool Overh'd Rly.	„ 29	3,952	+ 166	13	21,934	+ 1,801	6·6	..
Llandudno-Col. Bay	„ 27	317	+ 12	13·5	14,556	+ 620	6·5	..
Lond. Elec. Ry. Co.	„ 28	25,575	+ 180	13	157 675	+ 4,785	21·25	..
Mersey Railway	„ 28	4,488	+ 345	13	26 877	+ 3,066	4·5	..
Metropolitan Rly.	„ 29	35,851	+ 443	13	216,688	+ 5,457	25·75	..
Met. District Rly.	„ 28	24,707	+1,950	13	154,475	+15,528	25	..
†Anglo-Argentine	„ 23	59,280	+5,556	39	1,984,988	+72 811	..	..
‡Auckland	Aug. 30	18,602	+2,884	2	40,460	+ 8,506	24·1	..
Bombay (B.E.T.)	Sept. 9	5,996	+ 849	35	107.047	+ 5,117	..	..
‡Brisbane	Aug.	27,680	+3,080	8	158,994	— 5,126	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Sept. 28	8,805	+ 318	..	..	+11,336	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A.	Aug.	8,387	..	..	25,587	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	Sept. 15	1,785	+1,633	..	28,855	+ 8,165	14 7	2
‡Montevideo	Aug.	26,249	+2,234	10	290,107	+39,334	..	..
Perth (W.A.)	Sept. 27	3,644	+ 589	..	72,816	+10,298	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
	*					
Bournemouth & Poole, Ord. ..	10	5½	5†	9¾ — 10¾	..	5 2 4
Do. 4½ % Pref.	10	4½	4½	8¾ — 9¾	..	4 12 4
Do. Second 6 % Pref. ..	10	6	6	10½ — 10¾	..	5 11 7
Do. 4½ % Deb. Stock	Stock	4½	4½	98 —100	..	4 10 0
Brompton & Kensington, Ord...	5	10	9†	8½ — 9½	+ ⅛	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8¼ — 8¾	+ ⅛	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	97 —100	..	4 0 0
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3¾ — 4¼	..	5 6 0
Do. Do. 4 % Deb... ..	¼	4	4	94 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	8	6†	17 — 19	— ¼	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12½ — 14	..	4 5 9
Do. 5 % Deb.	Stock	5	5	118 —122	..	4 2 0
Do. 4½ % Second Deb. ..	100	4½	4½	99 —102	..	4 8 3
County of London, Ord... ..	10	6	4†	11¼ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 0
Do. 4½ % Deb.	Stock	4½	4½	106 —108	..	4 3 4
Do. 4½ % Second Deb. ..	Stock	4½	4½	100 —103	..	4 8 3
Edmundson's, Ord.	5	Nil	..	7/16 — 11/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3/16 — 5/16	..	Nil
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84 — 87	..	5 3 6
Folkestone	5	6	6	4⅜ — 5⅛ xd	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛ xd	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	92 — 95	..	4 14 9
Hove	5	9	..	7½ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2½	..	1⅝ — 2⅛	..	3 10 8
Do. 6 % Pref.	5	6	6	4¾ — 5¼	..	5 14 3
Do. 4 % First Mort. Deb. ..	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅝ — 4⅛	— ⅛	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	99 —102	..	4 8 3
Do. 3½ % Mort. Deb.	Stock	3½	3½	86 — 88	..	3 19 7
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	97½ — 99½	..	4 10 6
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	101 —104	..	4 16
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	10 — 11	..	5 9 1
Oxford	5	7½	6†	6 — 6½	+ ½	5 11 6
St. James' and Pall Mall, Ord.	5	10	10†	8¼ — 9¼	..	5 5 3
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 88	..	3 19 7
Smithfield Markets, Ord. ..	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	3 — 3½	..	5 14 3
Do. 5 % First Mort. Deb. ..	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref...	1	7	7	1¼ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99 xd	+ 1½	4 11 0
Urban, Ord.	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	..	2½ — 3	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½ — 88½ xd	..	5 1 8
Westminster, Ord.	5	10	9†	8¾ — 9¼	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	..	4 3 0

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5½ — 5¾	..	5 4 4
Calcutta, Ord.	5	8½	..	7⅞ — 8	..	5 6 3
Do. 5 % Pref.	5	5	5	4 15/16 — 5 3/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	95 — 97	..	5 3 1
Canadian Gen. El. Com. ..	$100	7	7	113 —118 xd	..	5 18 8
Do. 7 % Pref.	$100	7	7	118 —122 xd	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	8	..	¾ — 1	+ 1/16	3 0 0
Do. 5 % Deb.	100	5	5	94 — 97 xd	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	92 — 94	..	6 7 8
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	81 — 84	..	5 19 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 5/32	..	Nil
Do. 6 % Pref.	1	6	6	3/32 — 5/32	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	104 —106	..	4 14 4
Madras, Ord.	5	Nil	..	1½ — 2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102 —105	..	4 15 3
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	87 — 89	..	5 12 4
Mexican Lt. & Power, Common	$100	4	4†	94 — 97	..	4 2 6
Do. 7 % Cum. Pref.	$100	7	7	108 —111	—1	6 6 2
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	..	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86½ — 88½	..	5 13 0
Montreal, Lt., H. and Power ..	$100	8	9†	240 —250	..	3 4 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	39 — 42	..	..
River Plate, Ord.	Stock	10	..	240 —250	..	4 0 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	109 —114	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	102 —104	..	4 16 2
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital ..	$100	5	5	152 —156 +rts	— 2	3 4 1
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108 —110	..	4 11 0
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 5 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	94 — 97	..	5 3 1
Victoria Falls Power, Pref. ..	1	11¼d.	17⅛d.	5/32 — 1 3/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 —105	..	5 14 3

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	..	7¼ — 7⅝	..	5 3 3
Do. 5 % Deb. Red.	Stock	5	5	96 — 98	..	5 2 0
American Telep. & Teleg., Cap.	$100	8	8†	147 —149	—2	5 7 5
Do. Collat. Trust	$1000	4	4	93¾ — 95¼	..	4 3 9
Anglo-American Telegraph ..	Stock	8	8	68 — 70	..	5 7 2
Do. 6 % Pref.	Do.	6	6	113½ —114½	..	5 4 10
Do. Def.	Do.	80/-	..	26⅜ — 26⅝	..	5 11 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅜ — 7⅝	..	4 8 11
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	82½ — 84½ xd	..	4 14 8
Cuba Telegraph	10	6	..	9½ — 10¼	..	5 14 3
Do. 10 % Pref.	10	10	10	16½ — 17¼	..	5 14 3
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3¾ xd	+ ⅛	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7 xd	..	7 2 10
Direct United States Cable ..	10	5	4	7½ — 8	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	98 —100	..	4 10 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	130 —133	..	5 5 3
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	99½ —101½	..	3 18 10
Eastern Extension	10	7	7†	18½ — 19⅜	..	5 2 9
Do. 4 % Deb.	Stock	4	4	99 —101	+ ⅛	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 3
Globe Telegraph and Trust ..	10	6	6†	11 — 11¼ xd	+ ⅛	5 4 4
Do. 6 % Pref.	10	6	6	12⅜ — 13½ xd	+ ⅛	4 10 7
Great Northern Telegraph ..	10	18	18	28¾ — 29¾	..	6 1 0
Indo-European Telegraph ..	25	13	..	57 — 59	..	5 3 5
Mackay Companies Common ..	$100	5	5†	87 — 91	..	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	£8 — 71	..	5 12 8
Marconi's Wireless Telegraph	1	20	..	5 13/16 — 5 15/16	..	4 1 1
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅞ — 4⅛	— 1/16	3 17 8
Monte Video Telephone, Ord...	1	6	..	1 1/32 — 1 3/32	..	5 6 3
Do. 5 % Pref.	1	5	5	1 7/16 — 1 9/16	..	5 6 8
National Telephone Def. ..	Stock	6	..	154½ —156½	— ½	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	101 —102	+ ⅛	4 8 3
Oriental Telep. and Elec. ..	1	8	..	1 3/16 — 1 5/16	+ 1/16	4 6 4
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/32	..	4 18 5
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 9 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 —100	..	4 0 0
Reuter's	10	10	10†	11½ — 11⅝	+ ⅛	8 12 0
Submarine Cables Trust ..	Cert.	6	6	129 —132	+1	4 11 0
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99½ —101½	..	4 8 8
United River Plate Telephone	5	8	..	7 1/16 — 7 3/16	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 13/32 — 1 15/32	..	3 18 5
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 99	..	4 0 10
West India and Panama Teleg.	10	2½	..	3 5/16 — 3 9/16	+ 1/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10⅜ — 10¾	+ ⅛	5 10 4
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 10¼	..	5 17 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	18½ — 18⅝	..	5 1 10
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. *a* Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil		..	Nil
Do. 5 % Pref.	1	5	5		..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81 xd	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	+1	..
Do. 5 % Perp. Deb.	100	5	5	95½ — 98½ xd	..	5 1 6
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8†	78 — 80	+1	8 15 0
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	77 — 79	..	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	10	1½	1½†	41½ — 42½	+2	3 8 6
Do. 5 % Pref., 1891	100	5	5	107 —109	+1	4 11 9
Do. Do. 1896	100	5	5	105 —107	+1	4 18 6
Do. Do. 1901	100	5	5	104 —106	+1	4 14 4
Do. Do. 1908	100	5	5	103 —105	+1	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	1⅞ — 2⅛	..	Nil
Hastings Trams, 6 % Pref.	1	6	..	⅝ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	69 — 74 xd	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	2¼ — 2⅜	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	+2	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5⅝ — 6¼	+1/4	..
Do. 4 % Deb.	100	4	4	72 — 76	+1	5 5 3
Metropolitan Railway Consol.	100	1½	1½†	60½ — 61	−2½	2 13 3
Do. Surplus Lands	100	2⅜	2⅜†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	40¾ — 41½	−1	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅝ — 1⅞	+ 1/32	4 13 9
Do. Def.	1	Nil	..	1/32 — 1/16	+ 1/32	Nil
Do. 5 % Pref.	1	5	5	3/16 — 7/32	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	97½—100½ xd	..	4 19 6
Potteries, Ord.	1	8½	..	3/8 — 7/16	..	..
Do. 5 % Pref.	1	5	5	7/32 — 9/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	1/16 — 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4¼ — 4⅜	— 1/8	Nil
Do. "A"	1/-	..	..	3/16 — 3/32	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	— 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/32	..	Nil
Do. 6 % Pref.	5	3	..	2⅜ — 3⅜	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5⅛	5⅛	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5⅛	5⅛	4⅞ — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invs., Ord.	5	8	..	7¼ — 7⅜	+ 1/8	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	147 —152	+2	5 5 3
Do. Pref. Ord.	100	6	6	120 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108 —111	+1	4 10 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —106	+ 1/2	4 5 0
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 7 0
Calcutta Trams, Ord.	5	7	..	6 — 6⅛	+ 1/8	5 3 8
Do. 5 % Pref.	5	5	5	4⅞ — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	⅜ — ⅝	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	⅜ — ⅝	..	..
Do. Pref.	1	6	..	⅞ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	..	1 1/16 — 1 1/8	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	98 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 95	+1	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	126 —130	..	5 7 8
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	102 —104	..	5 15 5
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅛ — 7⅝	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½—102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅜ — 1⅝	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅝	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	160 —165	+5⅛	3 0 7
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	101½—102½	..	4 17 7
Sao Paulo Tram, Lt. and P.	$100	10	10†	280 —290	+17	3 9 0
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 14 0
Singapore Trams, 5 % Deb.	100	5	5	83 — 86 xd	+1½	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅝ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½—103½	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	⅜ — ⅝	..	8 0 0
Do. 6 % Pref.	1	6	6	7/16 — ½	..	7 7 8
Babcock & Wilcox	1	28	..	3 1/16 — 3 1/8	+1/16	4 1 5
Do. Pref.	1	6	6	1 1/16 — 1 1/8	..	3 16 10
British Aluminium, Ord.	1	Nil	..	⅜ — ⅝	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅜ — ⅝	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 18 8
B.I. & Helsby Cables	5	10	8†	7⅜ — 7¾ xd	..	6 7 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4¼	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	8	Nil	Nil	⅛ — 3/16	..	Nil
Do. Deb.	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 8
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 8 8
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10½ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅝ — 5⅜	..	4 17 7
Do. Deb.	100	4½	4½	99½—101½	..	4 8 8
Castner-Kellner	1	20	15†	3 1/16 — 3 1/8	..	5 1 7
Do. Deb.	100	4½	4½	103 —106	+1	4 5 0
Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	66 — 66	..	7 11 6
Dick, Kerr	1	5	..	⅜ — ⅞	..	5 14 3
Do. Pref.	1	6	6	1 1/16 — 1 1/8	+1/16	5 13 0
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1⅛ — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	6 17 8
Do. 5 % Second Deb.	100	5	5	72 — 75 xd	..	6 13 4
Electric Construction	2	2½	3⅜	⅞ — 1	..	7 10 0
Do. Pref.	2	7	7	1⅞ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95 xd	..	4 4 3
Henley's, Ord.	5	17	5†	12⅜ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅜ — 5	..	4 10 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11⅜ — 12⅜	..	..
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 17 7
Telegraph Construction	12	17½	5†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	¾ — 1	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13

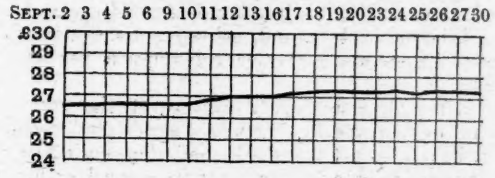
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

METAL MARKET.

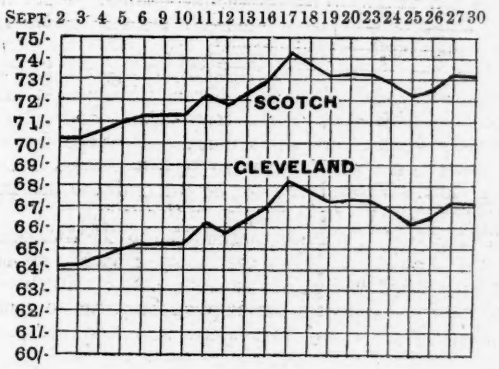
Fluctuations in September.

SPELTER (G.O.B's.).

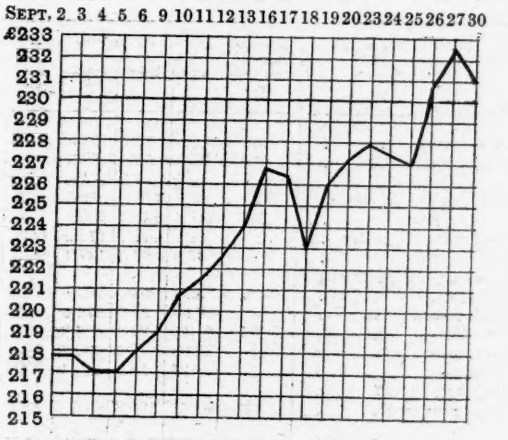


LEAD (ENGLISH).

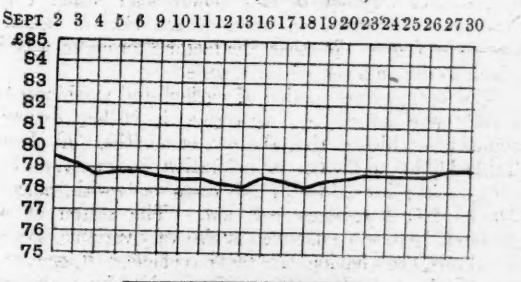
IRON.



TIN.



COPPER (G.M.B's.).



Battery Connectors.—The Crown Woven Wire Brush Co., of Salem, Mass., desires to receive from firms and others manufacturing battery connectors, samples and prices of their products.

A NEW TYPE OF INSULATOR.

Telephone and telegraph engineers are painfully aware of the troubles which arise in the use of the ordinary porcelain insulators, and it is therefore useful to draw attention to a new type of insulator which has been developed by the Minerallac Electric Co., of Chicago. This insulator is a non-breakable combination of insulator and pin in one piece, being turned out of a solid piece of wood which is then specially treated. This construction, by eliminating the joint between the insulator and the supporting section, renders the natural toughness of the specially selected wood available to resist the mechanical line stresses. Moreover, the absence of the joint prevents any moisture from creeping between the pin and the insulator. In the ordinary types, such creeping frequently results in swelling of the untreated wood of the pin and cracking of the glass or porcelain of the insulator. The strength of the wood is increased by the process of impregnation which is used, the compound used serving as a cement.

Insulators made of materal similar to that now used in this design have been in steady service for eight years on high-tension work, and it is claimed that they stand applied voltages of 33,000 without showing any deterioration in insulating qualities. The insulation resistance is stated at approximately 1,300,000,000 megohms per inch cube, and the dielectric strength as 1,000 volts per mil at 20 mils thickness. Another advantage which is claimed is that inasmuch as wood is a poor conductor of heat, moisture will not condense upon the surface of the insulator as it does upon glass or porcelain. The coldness of glass or porcelain causes a very rapid collection of moisture in a fog or mist. Moreover, the oily surface which is always found with this impregnated form of wood insulator prevents the collection of water or moisture in a continuous film during rains, while the glass or porcelain insulator will often have a thin film of water over the entire surface, causing rapid leakage or breakdown.

Instead of carrying insulators up the pole and screwing them on by hand as in the case of glass or porcelain, it is possible to put the complete installation on the cross-arm before distribution along the line. The weight of the wooden pin is about one-third that of a glass insulation pin, while wooden insulators can be installed with a hammer and do not break even if they are dropped to the ground from the height of the cross-arm.

From the point of view of maintenance, the cost of insulators and replacement of broken ones is insignificant compared with the expensive time and transportation of the lineman making the repairs. Insulator repairs at the present time constitute the greatest item of expense in overhead line work. With glass or porcelain insulators, the contracting of the tie wire is sometimes sufficient to break off the top of the insulator, while the presence of water causes swelling of the untreated pin. Another cause for lineman's service is one short pole between two taller poles; a change of temperature will cause the tightening of the line, the insulators being pulled from their pins and suspended in the air. A slight wind will then cause a short-circuit, which may require hours to overcome.

With the new insulator here described, any strain caused by contraction of the tie-wire, or upward pull caused by poles setting and the line tightening, can be withstood, while the compound with which the insulator is impregnated is, in addition to being a good insulator, an excellent preservative as well. It renders the wood waterproof, and, under ordinary conditions of use, it is claimed that such insulators should have a life of approximately 30 years. It, therefore, appears that the only person who will view the advent of this new insulator with regret, is the small boy who at present utilises the glass or porcelain insulator as a convenient target for stone throwing.

Electrolytic Copper in Norway.—H.M. Consul at Christiania (Mr. E. F. Gray) reports a Press announcement to the effect that the past 12 months has witnessed the erection, at Aamdal, of the first copper works to produce pure copper on the spot where the ore is mined, by M. Hybinette's process of extraction, during which the copper is elutriated from the ore by weak sulphuric acid and precipitated from the solution to pure copper by the help of electricity. The works will probably increase their production in the coming year to 3 tons of metallic copper per diem. The satisfactory results at Aamdal, and experiments with the so-called "kisafbrand," or pyrites burnings, from the Orkla Mine—one of the largest Norwegian copper and sulphuric mines—have brought into prominence the possibilities of a new Norwegian industry. Owing to the want of suitable Norwegian copper works, the Orkla and Sulitjelma Mines, in both of which foreign capital is largely interested, have hitherto exported their copper sulphur pyrites to Germany and Helsingborg, respectively, to have the copper extracted there. It now, however, appears likely that the Hybinette companies will receive the necessary support from Norwegian cellulose and other manufacturers interested in the consumption of sulphur, to enable them to take over this industry.—*Board of Trade Journal.*

Australian Tariffs.—The Australian Commonwealth Customs authorities have lately given a decision to the effect that "electrical appliances, &c., battery cells imported with, and for, telephonic wall or table sets," are to be classified under No. 178 (D) of the tariff, the duty being 17½ per cent. *ad valorem* on foreign goods and 10 per cent. on British productions.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Oct. 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	—	..	Nil
Do. 5 % Pref.	1	5	5	—	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81 xd	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	89 — 92	..	6 10 5
Do. 7 % Non-Cum. Pr'f.	100	..	..	39 — 42	+1	..
Do. 5 % Perp. Deb.	100	5	5	95½ — 98½ xd	..	5 1 6
Do. 4½ % 2nd Deb.	100	4½	4½	80 — 84	..	5 7 2
Central London Railway, Ord.	100	8	8†	78 — 80	+1	8 15 0
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	77 — 79	..	2 10 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1⅝	1½†	41½ — 42½	+2	3 3 6
Do. 5 % Pref., 1891	100	5	5	107 —109	+1	4 11 9
Do. Do. 1896	100	5	5	105 —107	+1	4 13 6
Do. Do. 1901	100	5	5	104 —106	+1	4 14 4
Do. Do. 1908	100	5	5	103 —105	+1	4 15 3
Do. 4 % Deb.	100	4	4	99 —101	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	—	..	Nil
Hastings Trams, 6 % Pref.	1	6	..	—	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	69 — 74 xd	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	..	—	..	4 11 0
Do. 4 % Deb.	100	4	4	77 — 82	+2	4 17 7
Lancashire United, 5 % Deb.	100	5	5	81 — 83	..	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	—	+1¼	..
Do. 4 % Deb.	100	4	4	72 — 76	+1	5 5 3
Metropolitan Railway Consol.	* 100	1911. 1⅞	1912. 1½†	60½ — 61	−2½	£ s. d. 2 13 3
Do. Surplus Lands	100	2⅞	2½†	64 — 66	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord.	100	Nil	Nil	40⅜ — 41½	−1	Nil
Do. 6 % Deb.	100	6	6	141 —143	..	4 4 0
Do. 4 % Deb.	100	4	4	95 — 97	+1	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 3
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 19 0
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 0
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅜ — 1	+ ⅛	4 13 9
Do. Def.	1	Nil	..	—	+ 3/32	Nil
Do. 5 % Pref.	1	5	5	—	..	5 6 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	97½ —100½ xd	..	4 19 6
Potteries, Ord.	1	3½	..	—	..	..
Do. 5 % Pref.	1	5	5	—	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	87 — 90	..	5 0 0
South Metro. Trams, 6 % Pref.	1	6	..	—	..	7 7 8
Do. 4 % Deb.	100	4	4	70 — 75	..	5 6 8
Underground Elec. Railways	10	..	..	4¼ — 4⅜	− ⅛	Nil
Do. "A"	1/-	..	..	—	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1½	£2	90 — 92	− 1	..
Yorkshire (West Riding), Ord.	5	Nil	..	—	..	Nil
Do. 6 % Pref.	5	3	..	—	..	4 9 0
Do. 4½ % Deb.	100	4½	4½	79 — 83	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5½	5½	4⅛ — 5⅛	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	..	4 4 3
Do. 4½ % Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 5 % Deb.	100	5	5	101 —103	..	4 17 1
Auckland Trams, 5 % Deb.	100	5	5	103½ —105½	..	4 14 9
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invs., Ord.	5	8	..	7⅛ — 7⅜	+ ⅛	5 3 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	100½ —103½	..	4 7 0
B. Columbia Elec. Rly., Def.	100	8	..	147 —152	+2	5 5 3
Do. Pref. Ord.	100	6	6	120 —125	..	4 16 0
Do. 5 % Pref.	100	5	5	108 —111	+1	4 10 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	99½ —102½	..	4 7 10
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —106	+ ½	4 5 0
Do. 4½ % Con. Deb.	100	4½	4½	101½ —103½	..	4 7 0
Calcutta Trams, Ord.	5	7	..	6⅜ — 6⅝	+ ⅛	5 3 8
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
Cape Electric Trams	1	2½	..	—	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 6 11
Do. 4 % Deb.	100	5	5	99 —102	..	4 18 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	—	..	Nil
Do. 5 % A Deb.	100	5	5	86 — 91	..	5 10 0
Do. 6 % B Deb.	100	6	3	35 — 43	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	—	..	..
Do. Pref.	1	6	..	—	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	..	1⅛ — 1⅜	..	4 11 5
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	100 —102	..	4 18 0
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 95	+1	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	126 —130	..	5 7 8
Do. Gen. Con. 5 % Bonds	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	102 —104	..	5 15 5
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7½ — 7⅝	..	6 7 0
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	100½ —102½	..	4 17 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5†	1⅛ — 1⅜	..	1 16 4
Do. 5 % 1st. Deb.	100	5	5	99 —102	..	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5½ — 5⅞	..	5 4 4
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 11 0
Rio de Janeiro Trams	$100	5	5†	160 —165	+5½	3 0 7
Do. 1st Mort. 5 % Bonds	..	5	5	103 —104	..	4 16 2
Do. 5 % Mort. Bonds	100	5	5	101½ —102½	..	4 17 7
Sao Paulo Tram, Lt. and P.	$100	10	10†	280 —290	+17	3 9 0
Do. 5 % 1st Deb.	$500	5	5	104½ —106½	..	4 14 0
Singapore Trams, 5 % Deb.	100	5	5	83 — 86 xd	+1½	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	..	5 2 0
Un. Elec. Trams Monte Video	5	7	..	5⅝ — 6⅛	..	5 14 3
Do. 6 % Pref.	5	6	..	4⅝ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	101 —104	..	4 16 2
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	101½ —103½	..	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	—	..	8 0 0
Do. 6 % Pref.	1	6	6	1⅛ — 1⅜	..	7 7 8
Babcock & Wilcox	1	28	..	3⅞ — 3⅞	+⅛	4 1 5
Do. Pref.	1	6	..	1⅛ — 1⅛	..	5 16 10
British Aluminium, Ord.	1	Nil	..	—	..	..
Do. 6 % Cum. Pref.	1	Nil	..	—	..	..
Do. 5 % Prior Lien Debs.	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	85 — 88	..	5 13 8
B.I. & Helsby Cables	5	10	8†	7⅜ — 7¼ xd	..	6 7 0
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref.	8	Nil	Nil	—	..	Nil
Do. Deb.	100	4	4	60 — 63	..	6 7 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	9	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	75 — 80	..	6 5 0
Do. 4½ % Deb.	100	4½	4½	50 — 55	..	8 3 8
Do. 4½ % Second Deb.	100	4½	4½	35 — 40	..	11 5 0
Callender's Cable	5	15	..	10¾ — 11	..	6 16 4
Do. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	99½ —101½	..	4 8 8
Castner-Kellner	1	20	15†	3⅛ — 3⅜	..	5 1 7
Do. Deb.	100	4½	4½	103 —106	+1	4 5 0
Crompton & Co.	8	Nil	..	—	..	Nil
Do. Deb.	100	5	5	56 — 66	..	7 11 6
Dick, Kerr	1	5	..	—	..	5 14 3
Do. Pref.	1	6	6	1⅛ — 1⅜	+⅛	5 13 0
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	—	..	Nil
Do. fully paid	5	Nil	..	—	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	72 — 75 xd	..	6 13 4
Electric Construction	2	2½	3¾	— 1	..	7 10 0
Do. Pref.	2	7	7	— 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 11	..	..
Do. Deb.	100	4	4	90 — 95 xd	..	4 4 3
Henley's, Ord.	5	17	5†	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4⅞ — 5	..	4 10 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
India-Rubber, G. & T.	10	..	..	11½ — 12½	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	84 — 86	..	6 13 4
Do. Deb.	100	4	4	98 —100	..	4 0 0
Willans & Robinson	1	Nil	..	—	..	Nil
Do. Pref.	5	Nil	..	—	..	Nil
Do. Deb.	100	4	4	58 — 60	..	6 13

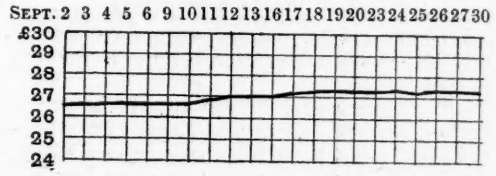
* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 4 per cent. August 29th, 1912.

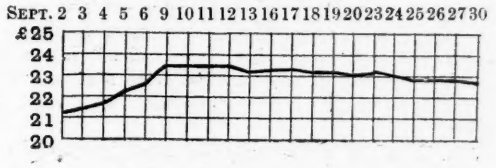
METAL MARKET.

Fluctuations in September.

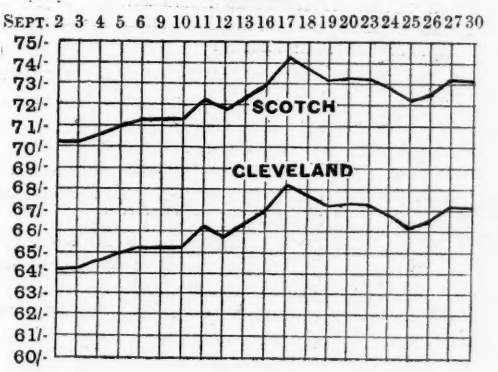
SPELTER (G.O.B's.).



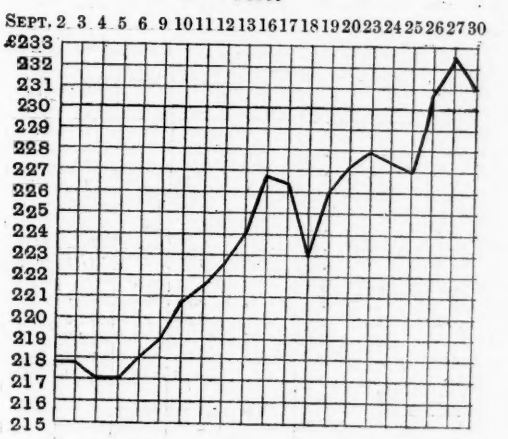
LEAD (ENGLISH).



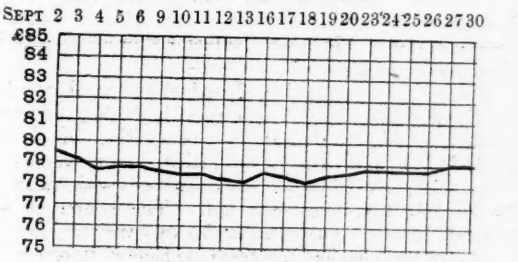
IRON.



TIN.



COPPER (G.M.B's.).



Battery Connectors.—The Crown Woven Wire Brush Co., of Salem, Mass., desires to receive from firms and others manufacturing battery connectors, samples and prices of their products.

A NEW TYPE OF INSULATOR.

Telephone and telegraph engineers are painfully aware of the troubles which arise in the use of the ordinary porcelain insulators, and it is therefore useful to draw attention to a new type of insulator which has been developed by the Minerallac Electric Co., of Chicago. This insulator is a non-breakable combination of insulator and pin in one piece, being turned out of a solid piece of wood which is then specially treated. This construction, by eliminating the joint between the insulator and the supporting section, renders the natural toughness of the specially selected wood available to resist the mechanical line stresses. Moreover, the absence of the joint prevents any moisture from creeping between the pin and the insulator. In the ordinary types, such creeping frequently results in swelling of the untreated wood of the pin and cracking of the glass or porcelain of the insulator. The strength of the wood is increased by the process of impregnation which is used, the compound used serving as a cement.

Insulators made of materal similar to that now used in this design have been in steady service for eight years on high-tension work, and it is claimed that they stand applied voltages of 33,000 without showing any deterioration in insulating qualities. The insulation resistance is stated at approximately 1,300,000,000 megohms per inch cube, and the dielectric strength as 1,000 volts per mil at 20 mils thickness. Another advantage which is claimed is that inasmuch as wood is a poor conductor of heat, moisture will not condense upon the surface of the insulator as it does upon glass or porcelain. The coldness of glass or porcelain causes a very rapid collection of moisture in a fog or mist. Moreover, the oily surface which is always found with this impregnated form of wood insulator prevents the collection of water or moisture in a continuous film during rains, while the glass or porcelain insulator will often have a thin film of water over the entire surface, causing rapid leakage or breakdown.

Instead of carrying insulators up the pole and screwing them on by hand as in the case of glass or porcelain, it is possible to put the complete installation on the cross-arm before distribution along the line. The weight of the wooden pin is about one-third that of a glass insulation pin, while wooden insulators can be installed with a hammer and do not break even if they are dropped to the ground from the height of the cross-arm.

From the point of view of maintenance, the cost of insulators and replacement of broken ones is insignificant compared with the expensive time and transportation of the lineman making the repairs. Insulator repairs at the present time constitute the greatest item of expense in overhead line work. With glass or porcelain insulators, the contracting of the tie wire is sometimes sufficient to break off the top of the insulator, while the presence of water causes swelling of the untreated pin. Another cause for lineman's service is one short pole between two taller poles; a change of temperature will cause the tightening of the line, the insulators being pulled from their pins and suspended in the air. A slight wind will then cause a short-circuit, which may require hours to overcome.

With the new insulator here described, any strain caused by contraction of the tie-wire, or upward pull caused by poles setting and the line tightening, can be withstood, while the compound with which the insulator is impregnated is, in addition to being a good insulator, an excellent preservative as well. It renders the wood waterproof, and, under ordinary conditions of use, it is claimed that such insulators should have a life of approximately 30 years. It, therefore, appears that the only person who will view the advent of this new insulator with regret, is the small boy who at present utilises the glass or porcelain insulator as a convenient target for stone throwing.

Electrolytic Copper in Norway.—H.M. Consul at Christiania (Mr. E. F. Gray) reports a Press announcement to the effect that the past 12 months has witnessed the erection, at Aamdal, of the first copper works to produce pure copper on the spot where the ore is mined, by M. Hybinette's process of extraction, during which the copper is elutriated from the ore by weak sulphuric acid and precipitated from the solution to pure copper by the help of electricity. The works will probably increase their production in the coming year to 3 tons of metallic copper per diem. The satisfactory results at Aamdal, and experiments with the so-called "kisafbrand," or pyrites burnings, from the Orkla Mine—one of the largest Norwegian copper and sulphuric mines—have brought into prominence the possibilities of a new Norwegian industry. Owing to the want of suitable Norwegian copper works, the Orkla and Sulitjelma Mines, in both of which foreign capital is largely interested, have hitherto exported their copper sulphur pyrites to Germany and Helsingborg, respectively, to have the copper extracted there. It now, however, appears likely that the Hybinette companies will receive the necessary support from Norwegian cellulose and other manufacturers interested in the consumption of sulphur, to enable them to take over this industry.—*Board of Trade Journal.*

Australian Tariffs.—The Australian Commonwealth Customs authorities have lately given a decision to the effect that "electrical appliances, &c., battery cells imported with, and for, telephonic wall or table sets," are to be classified under No. 178 (D) of the tariff, the duty being 17½ per cent. *ad valorem* on foreign goods and 10 per cent. on British productions.

AGRICULTURAL APPLICATIONS OF ELECTRICITY.

By Wm. MANKTELOW.

Apart from electroculture—or the direct application of electric currents or discharges to growing crops—a science which is not yet out of its experimental stages, electricity is now employed to replace manual labour in the preparation of cattle food, thrashing cereals, and in irrigation and general pumping work. Very little reliable data is available concerning the energy requirements and the average annual energy consumption of agricultural machinery, hence special interest attaches to a paper recently presented by M. P. Lecler to the Comité Technique du Syndicat Professionel des Usines d'Electricité. The author has collected useful figures from a number of farms in which electric driving is actually employed; thence he derives factors of interest to central station engineers, and considers means whereby agricultural loads can be increased in extent and made as favourable as possible to the supply authority.

TABLE I.—Capacity and Energy Consumption of Agricultural Machinery.

Apparatus.	Kg. of material handled per hour.	Watt-hours per hour.	Watt-hours per 100 kg. treated.
Grinding fattening food ...	2,000-2,500	2,600	125
„ fresh bones ...	13	150	2,000
„ oil cake	550	750	150
Crushing oats	16	200	1,000
„ maize	50	200	400
Flatting oats	400	110	275
Mill type crusher (oats) ...	50	300	600
„ (barley)	250	1,800	750
Beetroot cutter (with cleaner)	1,800	450-500	25
Chaff cutter	400	1,000	300-400
Dairy (per 100 quarts of milk)	—	—	285-570
Agricultural mill	70	1,600-1,800	2,500
Sorter	120	—	20
Winnower	600	—	50

In many cases agricultural machinery, designed for hand operation, is converted to electrical driving by the mere attachment of an electric motor and the necessary gearing. The performance of such a machine is generally much less satisfactory than that of a machine primarily designed for electric driving. An apparent exception is to be found in thrashing machines. Old-fashioned thrashers converted to electric driving by the installation of a 2 or 3 h.p.-motor require from 0·15 to 0·25 unit per cwt. of grain, whereas a thrasher specially designed for electric driving, and fitted with a 10-h.p. motor, requires 0·25 to 0·5 unit per cwt. It is only fair to note, however, that the latter apparatus has a much more complete arrangement for cleaning the grain. Apart from the humidity and general quality of the grain (both of which factors greatly influence the energy consumption during thrashing), the degree of attention in handling the machine greatly affects its performance. The light load demand of a thrasher is generally over 80 per cent. of the full load demand, and any inattention in feeding at once increases the average consumption per cwt. of delivery.

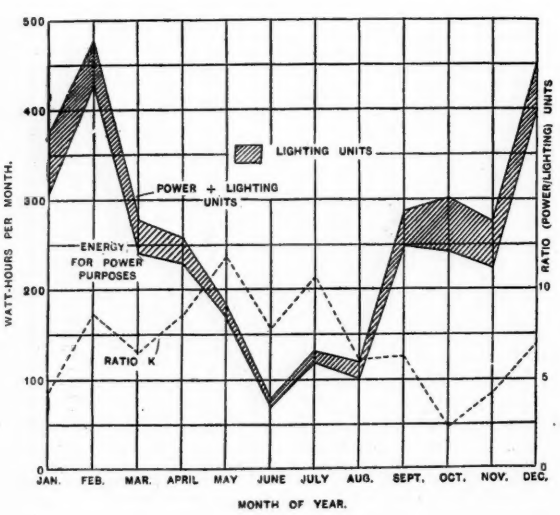


Fig. 1.

To cite only one further instance of the uncertainty attached to the power requirements of agricultural machinery, it may be pointed out that the demand of cylindrical grinders and crushers may rise to five times the normal or higher if the gap between the cylinders is set slightly too small.

Under these limitations as to accuracy, Table I shows the average energy consumption, including transmission and other losses, of various classes and sizes of agricultural machines. Better results could probably be obtained in specially designed apparatus, and it must be noted that the figures here and hereafter are based on a comparatively small number of cases.

Table II refers to a number of small farms, and shows the total motor horse-power installed and the average annual consumption for power and lighting, the machinery driven in the various cases being shown in column 1. Fig. 1 refers to a 620-acre farm, and represents monthly variations in power, lighting and total demand.

From the limited data available, it appears that small farms using such electrically-driven machines as are at present in fairly common use, consume an average of about 8 kw.-hours per acre per annum. In large farms the corresponding figure appears to be 5 kw.-hours per acre per annum. These figures are, according to the author, less than half those generally adopted in Germany.

The ratio of the energy consumption to the kw. capacity of the installation (taken over daily, monthly or annual periods), may be regarded as a "factor of utilisation" u. The ratio of the energy consumption for power to that for lighting purposes may be denoted by k, and enables an approximate estimate of the power load which may be expected in agricultural areas where electric lighting is already in vogue. Further, the factor k provides a basis on which to design a sliding tariff scale.

TABLE II.—H.P. Installed and Amount and Distribution of Annual Power Consumption on Small Farms.

—	Total h.p. motors installed. (P)	Annual kw.-hrs. for Power.	Light.	Total.	Coefficients of comparison. k= (P/L)	u= (P/P)
Grain sorter	1	48·3	75·2	123·5	0·64	48
Separator and churn ...	0·5	34·0	52·3	86·3	0·65	68
Ditto ...	0·5	75·7	95·7	171·4	0·79	151
Separator and lye washer	1	122·7	106·3	229·0	1·15	123
Ditto ...	1·5	248·3	135·3	383·6	1·84	165
Chaff and root cutters ...	1	41·1	131·1	172·2	0·32	41
Ditto ...	1	37·8	99·3	137·1	0·38	38
Kneading trough and root cutter	0·5	99·3	113·5	202·8	0·81	199
Grain crusher	4	223·0	53·6	276·6	4·17	56
Thrasher	3·5	253·5	92·8	346·3	2·74	72
Trasher and lye washer	4	333·2	97·0	430·2	3·45	82
Thrasher	4	350·2	99·2	449·4	3·53	86
Thrasher, chaff cutter and root cutter ...	4·5	506·6	139·8	646·4	3·61	112

The energy consumption of agricultural machinery varies greatly with the season; as a rule, it is low during the summer and high during the winter months. As shown by Table II the coefficient of utilisation is very variable but always low; its values in the cases dealt with, range from 38 to 200 kw.-hours per kw. The season at which demands have to be supplied is also very variable, so that of two loads, even having the same coefficient u, one may be favourable and the other unfavourable from the supply station standpoint. This is well shown by figs. 2 and 3, from which it appears that u for dairies is fairly uniform throughout the year, except in very large dairies where the summer increase in the volume of milk dealt with and the

necessity for refrigerators, &c., involve an appreciable summer peak.

Machinery for the preparation of cattle food is chiefly required during the winter months; grain crushers are chiefly worked from August to January, and root and chaff-cutters from January to April. The value of a thrashing machine load to the central station varies with the policy adopted by farmers in the district. If thrashing is performed immediately after the harvest a high steady day load is

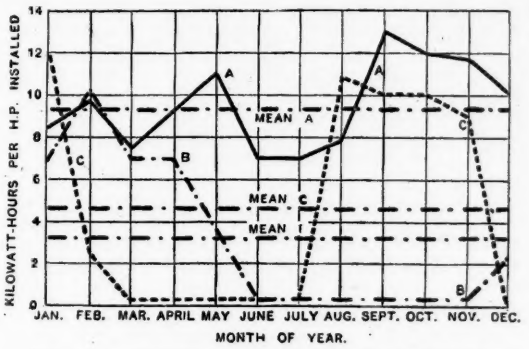


Fig. 2.—A, Dairies; B, Chaff and Root Cutters; C, Crushers.

obtained in August. If, however, a small thrashing machine is used in the farm buildings at odd times during the winter, it is generally used in bad weather and during winter evenings; it will then offer a most unfavourable load curve. Fig. 3, the average for four farms, shows the average result of both styles of working. Dairy demand is invariably a day load; root, grain and chaff machines are not tempting to the central station.

Cheap supply is essential if electricity is to be freely employed on farms, but the tariff adopted should certainly encourage day working during summer months in order to counteract as far as possible the natural tendency to perform indoor power work during the winter and in bad weather and after dusk. Owing to the fact that outdoor work is

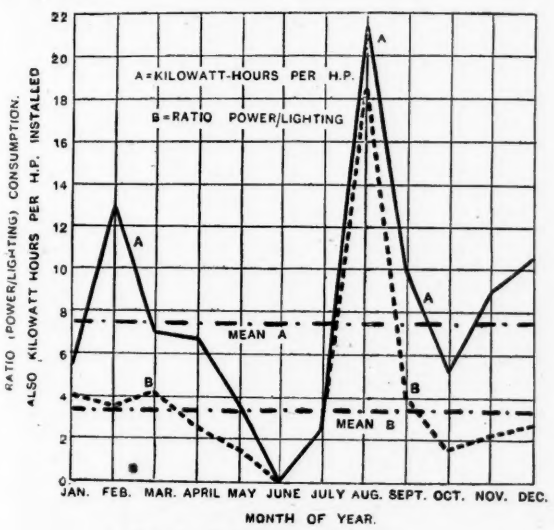


Fig. 3.—Threshing Machines.

practically at a standstill during November, December and February, it is a moot point whether a tariff can be designed which will have the desired effect.

The ratio of the power to the lighting consumption varies with the size of the farm, being less than one for small concerns and from five to six for large farms.

Typical values are shown in Table II and figs. 1, 3. The numerical value of K is roughly equal to H.P. of motors installed up to 5 H.P. The power consumption naturally becomes relatively greater the larger the farm, in fact, it may be taken as roughly proportional to the area of the farm, whereas the lighting consumption is made up of an approximately constant quantity (for the lighting of the farm house and outbuildings), and an additional quantity varying with the size of the farm and covering such lighting requirements as vary with the latter.

It is obvious that in the near future the power demand on farms employing electric driving will be quite preponderant; for instance, an electric plough requires 10·5 — 12·5 watt-hours per cb. yard of soil worked so that this demand alone, where present, would quite swamp the lighting load.

The present subject is of vital importance to agriculturists (as offering a solution to the present shortage of farm labour); to central stations (as offering a valuable increase in day load); and to electrical and agricultural manufacturers. It is highly desirable that a systematic collection of practical data should be commenced in as many districts as possible in order to provide reliable information as to design of apparatus, tariffs and as a guide to the policy of all parties concerned.

BUYING DEPARTMENTS.

By A. Traveller.

A little consideration will prove that a few notes on the above subject may be valuable. As much profit can be made and business extended by good buying as by smart selling. Yet, as a rule, how little attention is given to the former as compared with the latter!

We will commence with the office or works entrance. All too prevalent is the small counter across a narrow passage or the still smaller window marked "Inquiries." Where such an approach is permitted, it is safe to hazard that the individual who will attend to you is a diminutive office boy, who, in a shrill voice, asks you what you want, or throws in front of you a slip of paper, on which you are to write your business. If you are personally unknown to the buyer, the betting is ten to one against an interview.

As this procedure is equally applicable to any visitor—customer or otherwise—it is almost unbelievable that it should be allowed to continue in a single instance. It is unbusinesslike, irritating, and leads to much delay.

Almost as bad as the youthful guardian of the portals is the commissionaire or lady typist. Although invariably these good people are polite and eager to assist you, yet, for one, my heart drops when I observe that my business has to filter through the brain of either of these worthies.

The remedy is simple, and the slight additional cost would be soon recouped by the time saved and the better conduct of business. Appoint a man of discretion, with a good experience of the particular office, whose duty it would be to interview visitors and to inform travellers either who to see, or that there was no prospect of business being done in their line.

Whilst in many firms the selling side of the business is elaborately organised and conducted by high-salaried officials, yet the buying is greatly neglected and proceeds on the most casual lines; the actual placing of the orders being frequently left to a junior with other work to do. The result is that there is no system or economy shown, and the young buyer is open to the influence of an affable or, may be, generous traveller.

Due to the excellent management, and the very keen competition, the business organisation of the large West End shops is the most highly developed of any. In these establishments the buyer is one of the highest paid of the staff. Certain hours are purposely set aside to interview travellers, who are therefore sure of at least an interested hearing.

Many firms may consider themselves more than sufficiently looked after by travellers, perhaps unduly bothered by them. If this is so it is to a great extent their own fault. It is a common occurrence for a representative in a special line—say, lamps or cables—to call on a firm, only to be put off being seen by some excuse. He naturally calls again and again, with the same result each time. One day he happens to see the buyer and learns that the firm has a contract for these goods. If the traveller were informed of this at

first, he would not be fool enough to waste his time by calling again.

Gas companies are putting up a good fight for continuation, which, with the internal competition in the electrical trade, will compel an overhaul to be made of the selling and buying organisation and systems. When that has been done, travellers will be courteously and intelligently received, ordering will be done on sound lines, and the pokey entrance and office boy attendant will be swept away.

It is the wisest people who anticipate, and who do not wait to be compelled to adopt beneficial innovations.

REVIEWS.

Growing Crops and Plants by Electricity. By E. C. Dudgeon. 1912. London: S. Rentell & Co. Price 1s. net.

The avowed purpose of this book is to interest the general reader, and to give the farmer, the market gardener and the amateur horticulturist a clear idea of what has been done, and is being done, in the application of electricity to growing plants. The first aim is realised tolerably well; but we doubt whether the farmer and market gardener will gain much satisfaction from the work. A summary is presented of the results obtained by various experimenters since the pioneer investigation of Prof. Lemström.

Chapter III summarises the results of the author's experiments at Lincluden (chiefly on potato crops), and Chapter VII deals with her investigations as to the effect of the mercury arc light in a 20 × 10 ft. greenhouse. In studying the data of the various trials, we are impressed by the very high percentage of cases in which, owing to natural causes, breakdown of plant, disease or insect, &c., the results obtained were "irregular" or "not satisfactory," "not favourable to the discharge," and so on. The total amount of practical data relating to electro-culture is, after all, very limited, and we agree with the author that there is a fruitful field of enterprise open to anyone with capital and energy to investigate the subject thoroughly. Until more data, of more definite nature, are available, the average farmer or market gardener cannot be expected to risk capital in the matter. Experiments on a small scale are of very limited value: it is the results and cost of wholesale electroculture which must determine its practical value. This at once leads us to a most serious omission in the present book. Nowhere, except in a passing mention of a new system, yet untried, is any information given as to the cost of installing and operating the equipment required for electroculture. Neither are details given as to the actual arrangement of apparatus and conditions of working in the more important trials mentioned. So far as the practical agriculturist is concerned, these omissions are fatal.

The matter of the treatise is chiefly a statement of experimental results, and affords in a compact form a *résumé* of the most important work which has been done in this field. The writer's style is difficult to follow in places, and the English is not always above criticism. One sentence, in Chapter VIII, contains 142 words, and, perhaps naturally, does not make its point at all clearly. Throughout the book a careful revision of the proofs would easily have remedied a number of defects in composition. Tabular matter is set out regardless of space occupied. A handsome appearance is thus secured, but, by arranging the data in a few large tables (using a smaller type), much space would have been saved, comparison of results would have been facilitated, and additional text might have been included. Pages 6 and 7 are each devoted to one half-tone illustration (8·5 × 6 cm.), which have not even the merit of being specially interesting.

We are not convinced either as to the possibilities of improved stock rearing in an electrified atmosphere or as to the relevancy of this branch of electroculture to the subject in hand. Surely there is enough pertinent material available to avoid the devotion of over half a page to electrically-*heated incubators* in a work claiming to deal with *growing crops and plants* by electricity!

Chapter VIII suggests that the beneficial effect of electroculture depends on the nitrification of the soil by silent discharge from overhead wires; on facilitated assimilation of plants and assisted capillary attraction of moisture; and on augmented flow of sap and increased formation of starch and sugar. These are, however, no more than probable explanations. While we should have preferred a modified arrangement of the data presented and the inclusion of some definite estimates as to the present possibilities of electroculture, the work should certainly interest the general reader and should encourage the practical agriculturist to pursue the study of this subject and its immense potentialities.

La Costruzione delle Linee Elettriche Aeree. By Dott. Ing. Italo Brunelli. Rome: Stabilimento Cromo. Tip. di Carlo Colombo. Lire 7.50.

This book is a comprehensive study of overhead electrical conductors, their uses, construction, erection and maintenance. The author rightly points out that as a special branch of engineering, and a very important one, the subject of overhead lines has not had the complete treatment that has been accorded to subterranean cables. This is perhaps natural considering the smaller financial interests concerned, but a work of this kind is none the less welcome as a book of reference to be used by designers and constructors of overhead lines for telephone, telegraph, lighting and power use. In most other treatises on overhead work, the part especially relating to tramway work, an important branch, is confined to very general remarks about the suspension of the wire, and devoted more to the details of the poles and ornamental fittings. There are no unnecessary or useless theories in this book, but the whole subject is treated, from the principles involved to the practical carrying out of them. The book confines itself almost entirely to single overhead wires, dealing only slightly with overhead cables.

Part I is concerned with the materials used in constructing overhead lines, taking in their order conductors, insulators and supports. The author gives comparisons between the uses of aluminium, bronze, iron, and mixed steel and copper wires. He shows that for the same conductance, an iron wire weighs six times as much, and has $2\frac{1}{2}$ times the diameter of a bronze one with a conductivity of 88 per cent., and costs $1\frac{1}{2}$ times as much. These disadvantages become less with the smaller diameters, also when a low resistance is not specially required.

There is nothing of special interest in the genera electrical and mechanical tests described for the material of the wire. A detailed comparison is given of various types of line insulators and their supports, *i.e.*, the stems, brackets and poles, with special reference to the respective advantages of wood, iron and armoured concrete poles. The subject of insulators might have been dealt with more fully, as they form such an important part of the construction of high-pressure lines. The action and effect of sparks over high-pressure insulators are not even mentioned, and only one type of the Hewlett interlink suspension insulator is shown.

In the chapter on poles, it is shown that, for most ordinary transmission lines, wooden poles are the most economical. In this connection, it may be mentioned that the Société Electrotechnique de Dresden has lately published a very interesting account of methods of impregnating wooden poles with preservative fluids, as described in a paper by Messrs. Hattenburg and Berdenick, with an account of the electrolytic replacement of the natural sap by saline solutions.

Part II of the present work commences with the study of the effects on the material of a conductor of suspending it from supports some distance apart, showing the special conditions of stress it is subjected to. There is a useful rule given that for iron wires the normal tension to be used will be equal to the weight per kilometre of the wire. This applies also to phosphor-bronze wire, but for bronze wires for telephone use, and for aluminium wires, the normal tension should be one and a half times the kilometric weight.

The general formula of catenary curves is worked out, as being the basis of all calculations for stresses on overhead lines, and an approximation in view of the flatness of the curve in ordinary lines is arrived at which brings the

equation for the curve to that of a parabola. An example is given to show that the approximation is one that does not lead to serious error. The rule is also quoted that the tension at the point of support is equal to the tension at the vertex of the curve plus the weight of a length of the wire equal to the dip of the line. The minimum tension at the supporting points occurs when the dip is equal to one-third of the distance between the supports. Catenaries with points of support at different levels are considered here; also special cases such as the breaking of one of the supports, and the resulting alteration of the tension on the points at either side. A careful study is made of the influence of temperature on line wires, and of the influences of snow, ice and wind. Methods of damping vibrations of overhead wires are described.

This part concludes with the calculation of the flexibility of various kinds of pole supports, and also deals briefly with the catenary support used for high-speed railway and cross-country lines.

Part III is concerned with the fittings, the lay out, and the erection of overhead lines, dealing first with the important question of the proper spacing of the poles. The cost of erection is dealt with in some detail. Jointing, fixing and erecting the wires themselves are gone into fully in this part, which concludes with the special conditions affecting lines for electric traction.

There follows an appendix on the subject of the construction and laying of cables for underground and submarine use. Although treated very briefly, the general principles of cable laying are put in an interesting and accurate way. This part of the book would not be of great practical value to the engineer engaged in submarine cable work, the matter being treated too briefly, but the very complete and clear way in which the main chapters of the book, dealing with overhead lines, is written makes the book a valuable one. In either the preliminary stage or the constructional stage of an overhead line scheme for telegraphy, telephony or power transmission, it would be an advantage to have such a book at hand.

Telephony. By McMeen and Millar. 1912. London: Crosby Lockwood & Co. Price 17s. net.

For some years past it has been sometimes a pleasure, sometimes not altogether a pleasure, to the writer to express his opinion upon sundry books dealing with the application of electrical science to the practice of telephony and the allied arts. Very rarely has it been possible to express other than qualified praise; many otherwise excellent books have appeared from time to time, spoiled because of the authors' or publishers' lack of appreciation of what properly constitutes a text-book. Of works there are many containing a wealth of useful information, well written in most cases, with carefully-prepared and well-drawn illustrations, but designed solely to serve as aids to the passing of the many examinations with which an earnest student is confronted nowadays as a result of an unfortunate craze which exists at the present time. This is, of course, not the place to indulge in a dissertation upon the ethics of true scientific education and the examination system which has of recent years grown up; neither has the writer any quarrel with the authors and publishers who, recognising the need for their works, cater for the potential examinee. Such is a matter of pure business. But the writer's objection is to the classifying and calling of such works text-books, for it is obvious that clothing the information to be conveyed in language adopted for ready assimilation and reproduction, where reasonable clarity of argument is often sacrificed to extreme conciseness, is not the best method for the production of a book whose aim should be to make clear all about, and everything in connection with, the subject therein treated. One such book came before the writer some time ago, an admirable production, embodying the infinitude of detail and description usually associated with books having their origin on the other side of the Atlantic, but, unfortunately, it made use of language somewhat akin to that associated with the alleged humour of pictures depicting the troubles of telephone employés engaged in negotiating wayleaves with the assistance, or otherwise, of an irate bull.

Now the book before the writer at the moment is a text-book. It describes in detail everything telephonic; it is written in language of which an Oxford man need not be ashamed—that is, assuming that after his three years at the University, he spent some nine or ten in the States—in other words, the book does not require to be translated into English idiom, or, perhaps, one should rather say *out* of American idiom. There is no padding of the earlier chapters with descriptions of historical attempts to achieve a telephone service—and, above all, there is no list of questions at the end, supposed to be, but rarely in fact, worked out and answered by the reader.

The opening chapters contain a very brief and most sensible reference to historical progress in telephony, a splendid chapter on acoustics, with special reference to the electrical reproduction of speech, electrical signals, and telephone lines with their peculiarities, only now beginning to be understood generally. There are separate chapters on the elemental instruments used in telephony, transmitters, receivers, switches, batteries, &c., which, in the scheme of the book, go to form a basis upon which are built up the later chapters dealing with switching systems, from the most elementary magneto board to the most up-to-date common battery switchboard and automatic switchboard. In the space available one cannot possibly enumerate all the contents of this book, but readers may understand that there is nothing in any way connected with the use of a telephone which is not adequately and clearly described. Both illustrations and diagrams are of a very high order of merit, and in connection with the latter there is one feature worthy of special comment. That is the use of conventional symbols which are fully explained in such a way that one has no difficulty in reading the diagrams, even where they are seemingly most involved.

Of course, as regards outdoor line construction, American practice, which differs much from that obtaining in this country, is described, but this in no way discounts the value of the book. There is one particular chapter to which reference may be made, and that is the one dealing with the control of railway traffic by telephone. The method, suitably modified to meet the conditions, is believed to be in use on at least one of our railways. It might possibly repay the others to study the matter, and if so the present book would prove of no little assistance.

The price of this book may seem high (17s. net.) to those who are—may one say—out to obtain diplomas, but to those who want to *know*, the price is by no means exorbitant. To such it may be confidently recommended.—R.M.H.

THE PRESENT POSITION OF ELECTRICITY SUPPLY UNDERTAKINGS IN VICTORIA, AUSTRALIA.

An interesting report has recently been presented to the Parliament of the State of Victoria, Australia, showing the present position of electricity supply undertakings in the State. Under the State Electric Light and Power Act of 1896 all such undertakings have to obtain a separate Order in Council, and to supply annually particulars of their technical position.

It appears that since the passing of the Act 66 orders have been passed; in 4 cases the preliminaries have not been completed, leaving 62 actually granted. Of these 8 have been cancelled, 1 has ceased operation and 1 was not proceeded with, leaving 52 in operation, 8 of which have been transferred from their original holders. Two existing orders were granted in 1898, one in 1899, two in 1900, two in 1901, one in 1903, two in 1904, two in 1905, one in 1906, four in 1907, six in 1908, five in 1909, eight in 1910, and 16 in 1911.

These figures show that although for the most part the new undertakings are small, there is a considerable increase in the public interest in electricity supply.

The following particulars of the principal undertakings indicate the progress which has been made in popularising the use of electrical energy :—

(*a*) *Melbourne City Council* supplying city area—4,393 consumers; 1,003 public arc lamps; 1,481 private arc lamps; 1,878 motors connected; 6,808 total H.P. of motors; 7,006 KW. total capacity of generating station.

(*b*) *Melbourne Electric Supply Co., Ltd.*, supplying outlying districts.—6,407 consumers; 162 public arc lamps; 1,425 private arc lamps; 1,266 motors connected; 6,609 total H.P. of motors; 5,775 KW. total capacity of generating station.

(*c*) *Electric Supply Co., of Victoria, Ltd.*, supplying the town of Ballarat.—886 consumers; 35 public arc lamps; 247 private do.; 1,000 KW. total capacity of generating station.

This station supplies energy to the local tramways having 20 cars, 12½ miles of track, and carrying 2½ million passengers per annum.

(*d*) *Electric Supply Co., of Victoria, Ltd.*, supplying the town of Bendigo.—798 consumers; 128 public arc lamps; 142 private do.; 1,300 KW. total capacity of generating station.

This station supplies energy to the local tramways having 16 cars, 9½ miles of track, and carrying 2½ million passengers per annum.

(*e*) *The North Melbourne Electric Tramways and Lighting Co.*, supplying the Essendon, Flemington and Kennington districts of Melbourne.—497 consumers; 750 KW. total capacity of generating station.

This station supplies energy to a tramway system have 15 cars, 10 trailers, 7 miles of track, and carrying 2½ million passengers per annum.

(*f*) *The Melbourne Electric Supply Co., Ltd.*, supplying the town of Geelong.—1,000 consumers; 293 private arc lamps; 212 motors connected; 1,263 total H.P. of motors; 800 KW. total capacity of generating station.

(*g*) *The Nhill Electric Light Co. Propy., Ltd.*, supplying the town of Nhill.—81 consumers; 10 H.P. of motors in use; 863 private incandescent lamps; 75 KW. total capacity of generating station.

The station plant includes one suction gas producer and gas engine, one direct-current dynamo, accumulator battery and one steam stand-by set.

(*h*) *The Borough Council of Inglewood* supplying the town of Inglewood.—73 consumers; 706 incandescent lamps; 24 KW. total capacity of generating station.

(*i*) *The Hamilton Electric Supply Co., Ltd.*, supplying the town of Hamilton.— 120 consumers; 5 public arc lamps; 16 private arc lamps; 14 motors connected; 48 total H.P. of motors; 104 KW. total capacity of generating station.

The plant consists of two producer gas generator sets, 50 and 100 B.H.P., and one oil engine set of 26 B.H.P., with an accumulator battery.

(*j*) *The Kerang Council* supplying the town of Kerang.—180 consumers; 8 public arc lamps; 1 private arc lamp; 1 motor of 5 H.P.; 80 KW. total capacity of generating station.

(*k*) *The Donald Electric Supply Co., Ltd.*, supplying the town of Donald.—125 consumers; 6 motors; 23 H.P. total of motors; 32 KW. total capacity of generating station.

The plant consists of suction gas producer set and an accumulator battery.

(*l*) *The Kilmore Electric Supply Co., Ltd.*, supplying the town of Kilmore.—60 consumers; 5 public arc lamps; 2 private arc lamps; 17 KW. capacity of generating station.

(*m*) *The Rochester Town Council* supplying the town of Rochester.—127 consumers; 5 public arc lamps; 4 motors; 13 H.P. total of motors; 50 KW. capacity of generating station.

(*n*) *The Hampden Shire Council* supplying the town of Camperdown.—178 consumers; 11 motors; 18 H.P. total of motors; 80 KW. capacity of generating station.

(*o*) *The Hampden Shire Council* supplying the town of Terang.—167 consumers; 11 motors; 19 H.P. total of motors; 70 KW. capacity of generating station.

(*p*) *The Bulla Shire Council* supplying the town of Sunbury.—30 consumers; 2 motors; 14 H.P. total of motors; 100 KW. capacity of generating station.

(*q*) *The Mildura Shire Council* supplying the town of Mildura.—198 consumers; 65 H.P. total of motors; 105 KW. capacity of generating station.

(*r*) *The Leongatha Butter and Cheese Factory Co., Ltd.*, supplying the town of Leongatha.—82 consumers; 7 motors; 15 H.P. total of motors; 22 KW. capacity of generating station.

(*s*) *The Casterton Freezing Works Co. Propy., Ltd.*, supplying the town of Casterton.—125 consumers; 1 motor of 2 B.H.P.; 48 KW. capacity of generating station.

(*t*) *The Poowong and Jeetho Shire Council* supplying the town of Korumburra.—130 consumers; 5 motors; 18½ H.P. total of motors; 42½ KW. capacity of generating station.

(*u*) *The Drouin Co-operative Butter Factory Co., Ltd.*, supplying the town of Drouin.—42 consumers; 2 motors; 18½ KW. capacity of generating station.

(*v*) *The South Gippsland Creamery and Butter Factory Co., Ltd.*, supplying the town of Yarram.—52 consumers; 3 motors; 16 H.P. total of motors; 24 KW. capacity of generating station.

(*w*) *The Tatura Butter Factory and Farmers' Produce Co., Ltd.*, supplying the town of Tatura.—80 consumers; 25 KW. capacity of generating station.

(*x*) *The Charlton Electric Light and Power Co., Ltd.*, supplying the town of Charlton.—110 consumers; 45 KW. capacity of generating station.

(*y*) *The Footscray City Council* supplying the city of Footscray.—46 consumers; 1 motor of 22 H.P. Supplied in bulk from Melbourne City Council. Capacity of sub-station, 150 KW.

(*z*) *The Yarrawonga Shire Council*, supplying the town of Yarrawonga.—85 consumers; 1 motor of 3 H.P.; 45 KW. capacity of generating station.

(*aa*) *The Birchip Electric Supply Co., Ltd.*, supplying the town of Birchip.—120 consumers; 3 motors; 12 H.P. total of motors; 29 KW. capacity of generating station.

(*bb*) *The Euroa Shire Council*, supplying the town of Euroa.—76 consumers; 74 KW. capacity of generating station.

(*cc*) *The Rainbow Electric Light Co*, supplying the town of Rainbow.—19 consumers; 15 KW. capacity of generating station.

Although the capacity of many of these stations is at present small, they form the nucleus of progressive undertakings, and there is no doubt that in the near future many of them will show rapid progress.

A NEW METAL-VAPOUR LAMP WITH A WHITE LIGHT.

THE chief disadvantage of the mercury-vapour lamp at present is the peculiar colour of its light, and the many attempts hitherto made to improve this have not been very successful. Dr. M. Wolfke,* after experimenting with a large number of easily fusible metals and alloys in place of mercury, has now apparently solved the problem by the use of an alloy of cadmium with a small percentage of mercury. Cadmium is eminently suitable for the purpose, because (1) its temperature of vaporisation in *vacuo* is low (450° C.); (2) it does not attack quartz glass in any way; and (3) its spectrum, especially at the higher temperatures, contains a bright red line at a wave length of ·644 μ.

If pure cadmium alone is used in the lamp, a decidedly red light is obtained, but the addition of a small percentage of mercury (from 3 per cent. to 10 per cent., depending on the shape and size of lamp) converts this red light into a satisfactory white light, which does not distort the natural colours of objects any more than an ordinary open arc lamp does. This is due to the fact that the spectrum of the new lamp contains bright lines distributed amongst all the colours. Thus, the mercury introduces violet lines at ·405 μ and ·409 μ, a blue line at ·436 μ, green lines at ·492 μ and ·546 μ, and yellow lines at ·577 μ and ·579 μ, whilst the cadmium supplies blue lines at ·468 μ and ·48 μ, a green line at ·508 μ and a red line at ·644 μ. Owing to the fact that mercury vaporises at a lower temperature than cadmium, it is a simple matter to extract any excess of mercury present whilst the lamp is still connected to the air pump and so obtain the best percentage of mercury experimentally.

Two forms of lamp have been developed—one having a graphite annode and a cathode of cadmium and mercury, whilst the other has both electrodes of cadmium and mercury. The former is, however, far less economical, especially at low ratings, as can be seen from fig. 1, where

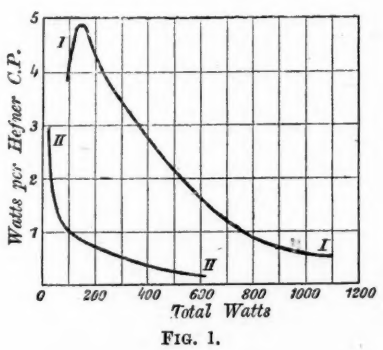


FIG. 1.

Curve I refers to the graphite anode lamp and Curve II to the other form. With graphite the consumption does not fall below one watt per Hefner candle-power until a total consumption of about 800 watts is reached, whilst the other form of lamp reaches this economy even at a total consumption of only 100 watts.

Careful experiment has further shown that the efficiency of the new lamp (with both electrodes of the alloy) is quite

* *E.T.Z.*, September 5th, 1912.

equal to that of the pure mercury vapour lamp, as is shown by the following Table :—

Total consumption in watts.	Cadmium-mercury lamp.		Mercury vapour lamp.	
	C.P.	Watts per C.P.	Watts per C.P. from one test.	Watts per C.P. from another test.
150	150	1·0	·87	—
220	310	·71	·68	·89
300	590	·51	·47	·64
380	960	·4	·34	·45
540	2,370	·23	·23	·29
620	3,800	·16	·21	·25

The figures for the pure mercury lamp here given are those published by R. Küch and T. Retschinsky in the "Annalen der Physik." 1906. Page 563.

The characteristic curves (or curves connecting terminal volts and amperes) of the various lamps are shown in fig. 2. Here Curve I refers to the lamp with anode of graphite and

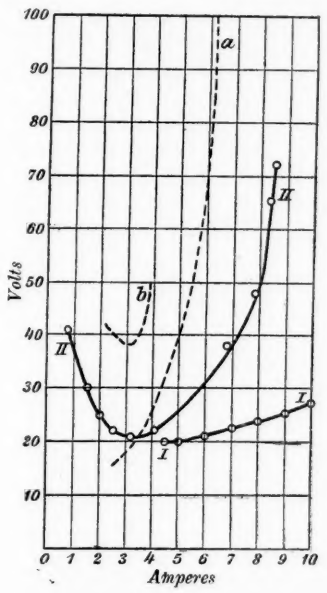


Fig. 2.

cathode of cadmium and mercury, Curve II to the lamp with both electrodes of cadmium and mercury and Curves *a* and *b* to the pure mercury lamps of Küch and of Cooper-Hewitt respectively. It will be seen that, for a given current, the mercury-cadmium lamp takes a lower voltage than the others ; but this disadvantage can be got over by employing specially small electrode chambers. In this way voltages as high as 100 have been used with small currents like 3 amperes. The cadmium-mercury lamp, like the pure mercury vapour lamp, requires a certain time to elapse after switching on, to arrive at its steady state. During this interval the voltage, the total watts and the candle-power increase gradually, whilst the current and the watts per candle-power fall.

The active material of the cadmium-mercury lamp being a solid at ordinary temperatures, it becomes deposited on the inside walls of the lamp when it gets cold after being extinguished. This causes no trouble in practice, however, because as soon as the lamp is switched on again the deposit is vaporised and the quartz glass walls become quite clear again. To ensure the absence of permanent deposit it is, however, essential to employ absolutely pure cadmium, free from all oxides, and this can only be attained by filling the lamp in vacuo.

For the purpose of striking the arc in these lamps the tipping arrangement generally used in the case of the mercury lamps is useless, because no liquid electrode material is present initially. Amongst the methods tried by the inventors are (1) the use of a small induction coil ($\frac{3}{8}$-in. spark length about) to give a spark between an auxiliary anode and the cathode ; (2) the use of the oxides of calcium, barium, strontium, &c., in the cathode so that when raised to a glowing temperature a large supply of electrons may be liberated and conduct the current across ; (3) the use of a flexibly supported auxiliary anode which, by shaking the lamp, can be made to bridge the circuit momentarily ; (4) the use of an auxiliary graphite anode moved electro-magnetically.

These methods are more or less applicable, but none of them are so convenient as two fresh methods devised specially for the new lamp. The first of these is applicable when a graphite anode is used. This anode *d* (fig. 3) is connected

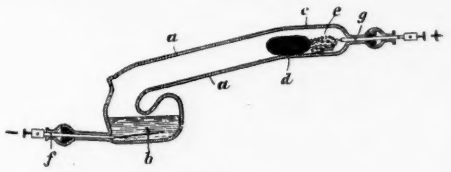


Fig. 3.

to the + terminal by a short iron chain *e*. By tipping the lamp the graphite slides down and touches the cathode alloy *b*, and so closes the main circuit. The current thus started then automatically tips the lamp back and strikes the arc, the iron chain curling itself up again in the anode chamber.

A better arrangement, and one suitable for lamps in which both electrodes are of the alloy, is that indicated in fig. 4. The action of this depends on the fact that the inside of the lamp near the electrodes becomes covered when cold with a dense conducting metallic coating. Near the

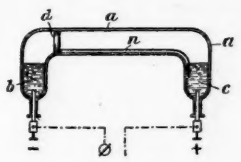


Fig. 4.

cathode *b*, against the wall of the tube, a contact ring *d* is fitted. This ring is connected to the anode *c* by means of a high-resistance conductor *n*, which may lie either inside or outside the lamp tube. In the cold state the portion of tube between *d* and *b* is thickly coated, and at the instant of switching on a current passes through this coating, and vaporises it. The arc then immediately jumps across from the cathode to the anode *c*. The arrangement is very simple and practical, and forms probably the best method for lighting these lamps with solid electrode material.

ABANDONMENT OF A CONTRACT.

[BY OUR LEGAL CONTRIBUTOR.]

It not infrequently happens that the builder or contractor is compelled to ask himself the question—Can I carry on the work with any chance of making a profit? If he sees no profit in the future, it will be necessary for him to consider whether immediate stoppage will not help him to cut his loss. That loss may be serious enough ; for he not only becomes exposed to an action for breach of contract, but will forfeit the value of all materials brought upon the site, and the value of work already done.

The mere fact that great difficulties are experienced does not justify abandonment. In Macdonald *v.* Mayor of Workington (1892), H.B.C. 222, a builder contracted with a corporation to execute certain sewerage work according to plan, specification, and working drawings. In the course of the work it was found that certain tunnelling specified was impracticable, owing to the quantity of water in the soil ; and the builder suggested certain modifications of the scheme. These proposals were rejected, whereupon he threw up the contract. In an action to recover the balance due to him on the contract, so far as it had been performed, Baron Pollock found for the defendants, and held that the builder could not

throw up the contract because the nature of the soil makes performance according to plans and specification difficult or impossible.

Similarly, the fact that difficulties are experienced with local authorities does not entitle a contractor to abandon. In one case a contractor agreed with the defendants to execute certain works according to plans and specifications, under the superintendence of the defendants' engineer, within a period of 18 months. During the progress of the works the plans were deviated from, and difficulties arose with certain landowners affected, in consequence of which the builder stopped work and sued to recover for work and labour done and money paid to the use of the defendants. It was held that a contractor to execute certain sewerage works for a sanitary authority under the Public Health Acts is not entitled to abandon the contract because of difficulties created by the landowners affected. (Dickinson *v.* Richmond Sewerage Board) (1893) H.B.C. (199).

Abandonment of a contract may also take place from the other side, as where, for instance, a building owner refuses to allow the work to proceed. In that case the builder or contractor is entitled to recover, as damages, all the expenses to which he has been put, and the profit which he would have made.

The mere fact, however, that the employer refuses to pay anything before work is handed over to him in a completed state is no evidence that he has abandoned his contract. In Rees *v.* Lines, 1837, 8 C. & P. 126, the plaintiff contracted to build a house for the defendant, according to a certain plan, for an agreed sum. After proceeding with the work and making a payment of £15 on account of the contract, the defendant, it was alleged, had abandoned the contract. In an action by the builder to recover the balance of the contract it was held that the fact that the defendant when asked for money, had stated that he would not pay a farthing, was not proof that he had abandoned the contract, for he was not then liable to pay anything as the work was not completed.

NATIONAL INSURANCE ACT, 1911.

Further Decisions of the Umpire under Unemployment Section of Act.

By JOS. J. H. STANSFIELD, F.C.I.S.

In the Electrical Review of August 16th last the decisions up to August 1st of the Umpire appointed under the provisions of the National Insurance Act, 1911, were set forth in an article by the writer. The present article contains the principal decisions affecting the electrical industry which have been passed since August 1st up to September 30th.

In many cases difficulties may have been found in deciding whether a workman was or was not included under the unemployment part of the Act, from the fact that at times many workmen are engaged on work that is clearly insurable and at other times on work which is exempt, and from the further fact that the Umpire in many of his decisions has used the words "wholly or mainly employed."

The difficulty arising in consequence of the use of the words "wholly or mainly" has, on several occasions, been brought to the notice of the Umpire, and he takes the view that these words should be applied to each payment of wages with reference to the period of service for which wages are paid.

If the workman has been employed on insured work for more than half the period for which wages are being paid, the Unemployment Book should be stamped. Thus, if a workman who is paid by the week has, during the week, been mainly employed on insurable work, his book should be stamped for that week; on the other hand, it should not be stamped if he has been mainly employed on uninsurable work. Similarly in the case of workmen paid at intervals shorter or longer than a week, the main employment during the period for which wages are paid decides whether the Unemployment Book has to be stamped or not.

This interpretation of the Umpire is only provisional, and must not be taken to exclude the possibility of a contrary interpretation in special cases should application be made to the Umpire.

In the meantime, however, the Labour Exchanges have been notified of the interpretation placed upon the words where there has been no special application, and as the Exchanges have the inspection of Unemployment Books placed in their hands, it will no doubt be considered advisable by those whom it may concern to act in accordance with the interpretation.

In the previous article it was stated that the Board of Trade proposed to make a general order exempting drivers and attendants of any vehicle and stablemen and other workmen employed in tending horses or to clean any vehicle. This order has now been made.

In many of the decisions it will have been noted that the Umpire has tried to distinguish between mechanical and electrical engineering and trades allied therewith, the former only being one of the scheduled trades. An interesting example of this is that the man who saws, planes or makes accumulator cell boxes is exempt, whilst engineers' fitters who machine moulds and make tools in connection with electrical storage batteries are liable to pay contributions.

The numbers in the various sections follow on from the article of August last.

Mechanical Engineering.—Contributions are payable in respect of the following:—

13. Testers of water meters and hydraulic fittings employed by way of manual labour (A. 731).

14. Electro-welding repairs to steam boilers, steel castings and other iron and steel structures, being mainly repairs to boilers of steam vessels (A. 744).

15. All classes of labourers employed in factories and workshops or in yards or stores immediately connected therewith, in a mechanical engineering establishment (A. 749).

16. (1) Making and repairing leather driving belts and leather hose pipes; (2) repairing and testing chains, all being for use in a mechanical engineering establishment (A. 803).

17. Manufacture of mechanical driving chains and chain gearing (A. 808).

18. (1) Driving cranes at works for unloading and loading material; (2) driving machinery and otherwise working in the mechanical engineering establishment of river conservators (A 812).

19. Boilermakers and labourers engaged wholly or mainly in repairs of boilers in connection with steel works or other businesses (A. 870).

20. Bricklayers and labourers engaged wholly or mainly in repair of boiler settings in connection with steel works and other businesses (A. 871).

21. Case-hardening parts of the products of a mechanical engineering establishment and in respect of sweaters employed in such an establishment soldering together metal parts with use of blow pipes (908).

22. Cranemen (hand or power), engineers and firemen (stationary engines) and boilermen (A. 933).

23. Fitting finished millstones to the hursting or grinding mill of a mechanical engineering establishment (A 950).

24. Manufacture of buffalo-hide pickers (A. 1,043).

25. Wholly or mainly making power-driven fans (A 1,054).

26. Engineers' fitters wholly or mainly filing up dies from patterns and making gauges and patterns from drawings in use in the manufacture of steam turbine blades (A. 1,063).

Electrical Engineering.—Contributions are payable in respect of:—

11. (1) In the manufacture of transformers, excluding coil-winding; (2) as toolsmiths and toolmakers (A. 728).

12. Building upon the site constructional work, such as . . . . switchboard galleries for electric stations, &c., and the preparation of the material for such on site, or in a constructional yard or shop (A. 740).

13. Armature disk notchers and stampers, core builders (A. 765).

14. Employés of an electric light and traction company engaged in the work of repairs to boiler, dismantling same

for inspection, and in repairs to engines in a power station (A. 786).

15. Electricians and assistants engaged wholly or mainly in the installation, upkeep, and repair of electrical machinery (including conductors), electrical wiring for power, light, or bells, in factories, workshops, and other buildings (A. 854).

16. Guillotine cutting punch press, stamping and twining of brass work for electric motor brushes for dynamos (A. 881).

17. Electric switch and contact makers engaged in the manufacture of automatic weighing machines for flour, sugar and cocoa (A. 888).

18. Manufacture and repair of vacuum cleaning machines (hand or power) including the woodwork but excluding the manufacture of hose pipes (A. 943).

19. Electric wirers in the roofing department of constructional engineers (A. 948).

20. Electricians and their labourers employed by tin mine owners in the upkeep and repair of electrical machinery and conductors (A. 953).

21. Manufacturing, assembling, erecting, or repairing of electrical switches, cut-outs, circuit-breakers and switchgear generally, including main and sub-station switchboards, motor control panels and starters and accumulator boards (A. 984).

22. Tool-makers making dies and tools used in the manufacture of lamps and gas and electric light fittings (A. 1,001).

23. Wholly or mainly making or repairing tools in connection with the manufacture of magnetos (A. 1,044).

24. Engineers' fitters machining moulds and making tools in connection with the manufacture of electrical store batteries (A. 1,068).

Contributions are *not payable* in respect of the following :—

24. Persons employed in the manufacture of electric fittings for billiard tables, but not including the installation of electric light in billiard rooms (B. 719).

25 Making or repairing electrical manufactures for torsion meters and other light instrument work (B. 726).

26. Making movable electrical cooking and heating apparatus (B. 727).

27. A scientific instrument maker engaged in assembling electrical measuring, testing and recording instruments (B. 730).

28. Making electrically-welded chain by machinery mainly for pulley blocks (B. 760).

29. Screwing, turning, boring, enamelling and boxing conduit fittings for electrical wiring (B. 794).

30. Ebonite and vulcanised fibre workers making insulating parts for the electrical trade (B. 805).

31. Making magneto-electric cycle lamps (B. 832).

32. Manufacture of electrical signs (B. 845).

33. Making or fixing electric letter signs, stall plates, &c. (B. 899).

34 (1) Art metal workers producing artistic wrought-metal, such as electric fittings, stove fronts and repoussé, silver, copper and brass work ; (2) packers of artistic wrought metal (B. 907).

35. Making moulds for shaping micanite for use in the manufacture of insulators (B. 932).

36. F xing on the site, or preparation, including dressing, enamelling or polishing of slate or marble to finished dimensions for electrical appliances (A. 952).

37. Employed on lathe and vice in the manufacture of arc lamps for cinematographs (B. 940).

38. (1) Wood turners and polishers, turning and french polishing wood parts for electrical fittings ; (2) wood machinists on drilling and turning machines, making electrical work, such as adaptors, wall plug covers, pillars for lamps, bobbins for electrical wire and conduit bushes ; (3) putting together and fitting with terminals electric fittings, such as wall plugs and adaptors ; (4) breaking down timber and cutting blanks for (2) above (B. 965).

39. (1) Fixing or mounting fuse-wire or strip on china, porcelain or other insulators ; (2) fitting and fixing fuses in protecting cases (B. 983).

40. Manufacture, assembling, erecting or repair of small switches, cut-outs, circuit-breakers, distribution boxes and other fittings commonly used for ordinary domestic services (A. 984).

41. Making carbons for arc lamps (B. 1,005).

42. Wholly or mainly sawing, planing and making accumulator cell boxes (B. 1,046).

Cables, Overhead Lines and Street Lighting.—Contributions are *not payable* for the following :—

15. Workmen employed by a Town Council wholly or mainly painting lamp columns (see also B. 547) (B. 734).

16. Painting street lanterns (B. 774).

17. Joiners and other workmen making wooden drums for electric light cables (B. 1,003).

Generation and Supply of Electrical Energy.—Contributions are not payable in the following cases :—

12. Theatre or music hall stage electricians and their assistants not engaged in wiring buildings or other work of a permanent character (B. 843).

13. Switchboard attendants or other workmen engaged wholly or mainly in minding, testing or driving electrical machinery, and not engaged wholly or mainly in the upkeep and repair of electrical machinery and conductors (B. 855).

14. Charging electrical accumulators (B. 1,005).

Tramways.—Contributions are payable in respect of the following :—

3. Brass-founders and other brassworkers engaged wholly or mainly in casting and machining of brass trolley-wheels for tramcars (A. 746).

4. Repairing controllers on tramcars (A. 789).

5. Wheelwrights, carpenters, smiths, fitters or other workmen, including unskilled labourers engaged wholly or mainly in the construction, decoration or repair of vehicles (A. 853).

6. Wholly or mainly in welding the track joints of tramway rails in the construction of new tramway lines, and in the reconstruction and alteration (but not the repair and relaying) of existing ones (A. 939).

7. Reconstruction of an existing railway, converting same from steam to electric (A. 980).

8. Fixing controllers on tramcars (A. 1,014).

Contributions are *not payable* for persons employed in :—

2. Tramway department of a County Council, inspecting material for tramway service (B. 785).

Works of Construction.—Contributions are *not payable* in respect of :—

1. Laying asphalt or tarred macadam in the yards of and the paths leading to buildings (B. 738).

THE SLAGGING TYPE OF GAS PRODUCER.

This gas producer receives attention in Technical Paper No. 20 of the U.S. Bureau of Mines, which is conducting tests upon it to show its value for fuels high in ash. With coke fuel and limestone flux for both intermittent and continuous runs up to 100 hours, the results point to success. Low grade fuels with high ash of 50 to 60 per cent. have succeeded in Europe, and in the U.S. with fuels up to 30 and 44 per cent. of ash have been tested in high grade fuel producers only.

Laboratory tests show that for high percentages of carbon monoxide, the fuel bed of a producer must have a temperature of 2,300° F. or more. Such a temperature fuses the ash and makes clinker difficulties. Now, if a producer is used of the blast-furnace type, the use of a suitable flux will remove this ash as slag. Bischof is said to have proposed a slagging producer in 1839. In 1840 one was built at the Audincourt Ironworks, in France, by Ebelmen, using charcoal, iron furnace slag and clay, which ran out as a fusible slag. One was built by Taylor, and worked at Chester, N.J., for four weeks with small anthracite and 30 to 40 per cent. of blast furnace slag as flux. The fuels used must have enough fixed carbon in their composition to develop the heat necessary to fuse the ash and do the other work of the producer. A battery of producers was installed at Gironcourt in 1907, using fuel of 20 to 25 per cent. ash, and giving a gas with 28 to 30 per cent. of CO and 9 to 10 per cent. of H and CH_4.

The Bureau of Mines uses a producer with a steel shell and brick lining and slag notch. There are six air tuyeres near the base, and four others at higher points for steam admission, fuel being charged at the top, where also the gas passes off very much as in the blast furnace. A cooling device is necessary in the combustion zone, a coil of pipe in the lining for water circulation, with 4½ in. of magnesite brick between coil and fire. The producer top also is water-cooled. The scrubber contains only water-sprays. The gas passes the fine water-sprays and is dry scrubbed by a layer of wood

wool; the air blast comes from a positive blower at 5 or 6 to 16 in. water-gauge, the blast being passed through a heater. Coke was first used as a simple fuel. Limestone will increase the fluidity of the slag, and with the first trials ½-in. crushed limestone was used. Analysis was of little use for fixing proportions, for so much of both fuel and lime was blown over by the blast.

Tests have been made with 4 to 28 lb. of stone per 100 of coke. Burning 30 lb. of coke per ft. of fuel bed per hour, and using 6 of stone to 100 of coke, the slag was semi-fluid, black and glassy when cold. The gas showed 31 per cent. of CO and less than 2 of CO_2. To get a low fusion slag 4 lb. of stone per 100 of coke was tried, but the slag would hardly flow and clinker accumulated 6 or 8 in. deep, though the gas was excellent.

Next, tests with 12, 20 and 28 lb. of stone were made under no steam as before, and the air blast at ordinary room temperature with a 6-ft. fuel bed. The slag ran freely with 12 lb. At 28 lb. the fluidity point was passed, and the slag would hardly flow. With 20 lb. of stone the results were satisfactory, the slag less viscous, and freely flowing and spreading readily when run. When the blast was preheated it was found possible to run with an intermittent period of four days. With a 76-hours' run the gas was regular and excellent at 31 per cent. of CO, and 1½ of CO_2 tapping the slag hourly. Limestone 15 lb., coke 20 lb. per ft. of bed. Air at 440°. Other good runs of 100 hours were made with 15 lb. of stone, and the use of 0·75 lb. of steam had no effect in reducing slag fluidity.

It may be remembered that Thwaite had a slagging producer on test at Leeds, and that blast furnace or slagging producers formed a feature in the gas power electrical scheme put forward in 1906 by Thwaite and Booth in their coalfields power scheme.

The success of a slagging producer must depend upon the cost of lime necessary to effect the fluxing and upon the possibility of making use of the slag by way of a raw material for cement manufacture. As a rule, a slag is deficient in lime if a cement is to be made, and lime must be added and ground up with the slag and the whole re-burned and ground. Some slags also serve well, when crushed, to form the basis of artificial stone. It is clear that the whole of the lime for a cement cannot be put through the producer, for this must be worked so as to give a liquid slag, an end not attained with either an excess or a deficiency of lime. The report before us is hopeful that the slagging producer will be a means of utilising low grade fuels.

For large gas producers it is certain that a really successful slag producer would be very helpful, for it would economise labour. A producer can be handled entirely by mechanical means, as regards its fuel and other charges, exactly like the blast furnace, of which it is but a modified example. With a slagging process the riddance of the ash or waste could be also dealt with on mechanical lines. It may be considered that so far no gas producer outside the blast furnace has been made of really large size. But, if a producer could be made really large enough to admit of mechanical ash removal apart from slagging, there is no apparent objection to be raised against the employment of a conveyor or chain scraper gear, which should remove the burned-out ash and clinker from the pit bottom of a water seal producer, so saving the wages cost of the present system of raking out, though this is more easy and quick to carry out than the raking which is necessary with the ordinary grate bottom apparatus.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

21,076. "Telephone systems." C. A. Whipple. September 16th.

21,102. "Electrical switches." B. D. Horton. (Convention date, October 23rd, 1911, United States.) September 16th. (Complete.)

21,115. "Electric pendulum and switch for controlling electric clocks." W. J. Parker. September 17th.

21,120. "Interlocking electric starting switchgear." A. H. Railing and C. C. Garrard. September 17th.

21,157. "Regulator for train lighting systems and the like." P. Kennedy. (Convention date, July 6th, 1912, United States.) September 17th. (Complete.)

21,179. "Electric indicating apparatus." Tyler Apparatus Co., Ltd., and E. H. Bishop. September 17th.

21,194. "Method of, and apparatus for, producing mezzotint, stipple, and other printing plates, and autographic, facsimile, and other telegraphic records." A. S. Bridgwater. September 17th.

21,212. "Electric cooking apparatus." T. Birkett and Simplex Conduits, Ltd. September 18th.

21,215. "Detachable sleeve for the inspection of wires in cables." J. A. Williams. September 18th.

21,244. "Telegraphy." E. D. Cather. September 18th.

21,263. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) September 18th.

21,281. "Electric furnaces." E. Stassano. (Addition to 8,901 of 1911.) September 18th. (Complete.)

21,290. "Electric furnaces." J. M. (known as Johannes) Bocuze. (Convention date, October 14th, 1911, France.) September 18th. (Complete.)

21,310. "Secondary cells, charging the same and utilising current therefrom." M. R. Hutchison. (Convention date, September 28th, 1911, United States.) September 19th. (Complete.)

21,334. "Printing telegraph instruments." E. J. Kessels. (Addition to 17,322 of 1910.) September 19th. (Complete.)

21,342. "Bedroom electric reading lamp and watch suspender." C. F. Clark. September 19th.

21,349. "Mountings or fittings for tubular incandescent electric lamps." D. Assersohn. (Addition to 17,855/07). September 19th.

21,351. "Telephone apparatus." R. Lagus. September 19th. (Complete.)

21,365. "Portable electric lamp for signalling and other purposes." J. Ormandy and G. W. Colmer. September 19th.

21,370. "Instruments for measuring electric resistances." E. I. Everett. September 19th.

21,410. "Electric water heaters or geysers." L. M. Waterhouse and Simplex Conduits, Ltd. September 20th.

21,411. "Electric arc lamps." A. H. Railing and A. E. Angold. September 20th.

21,415. "Direct current dynamos and motors." E. R. Freeman. September 20th. (Complete.)

21,433. "Brush-rocking apparatus for dynamo-electric machines." Pintsch's Electric Mfg. Co., Ltd., and C. H. Vidal. September 20th.

21,445. "Production of sheet mica and the like from mica waste and other materials." F. Bolling. September 20th. (Complete.)

21,446. "Calculating apparatus particularly adapted for reckoning out charges for the use of electricity, gas, water and so forth." H. Bruckmann. September 20th. (Complete.)

21,471. "Polyphase alternating electric current commutator motors." Siemens Schuckertwerke G.m.b.H. (Convention date, September 22nd, 1911, Germany.) September 20th. (Complete.)

21,472. "Cooling dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and W. Marden. September 20th. (Complete.)

21,478. "Electric furnaces for producing gas reactions." H. Pauling. (Convention date, October 24th, 1911, United States.) September 20th. (Complete.)

21,504. "Electric motor-regulating resistances." A. H. Railing and C. C. Garrard. September 21st.

21,533. "Electric-controlling devices for automatic photographic devices." S. Grossi. September 21st. (Complete.)

21,540. "Automatic thermic cut-out for electric lighting and power transmission circuits." A. Tasso. September 21st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

Dynamos. A. A. Price. 19,581. September 2nd.

Telegraphic Relays. S. G. Brown. 19,779. September 5th.

Quadruplex Hughes' Printing Telegraphs. G. Banzati. 19,815. September 6th.

Electric Safety Fuse. J. Muller. 19,856. September 6th.

Method of and Apparatus for Electrically Treating Plants, Seeds and the like. F. Muller and Veifa-Werke Vereinigte Electrotechnische Institute Frankfurt-Aschaffenburg. 19,962. September 7th. (June 20th, 1911.)

Electric Furnaces. A. E. Bourcoud. 20,033. September 8th.

Collectors for Electric Traction. R. C. Sayer. 20,100. September 11th.

Electric Switches. A. F. Berry. 20,171. September 11th.

Series Electrical Lighting. B. C. Atherton. 20,794. September 20th.

Electromagnetic Relays, Electromagnets and the like. Western Electric Co. (Western Electric Co.) 20,860. September 21st.

Automatic Electrically-Governed Engine Stop-Gear. H. D. Hinckley and W. D. Halliday. 23,359. October 23rd.

Electric Lamps for Motor Vehicles. H. Aron. 24,380. November 2nd.

Magnetic Clutches. A. T. Collier. 24,776. November 7th.

Means for use in Automatically Regulating the Timing in Magneto-Ignition Apparatus. H. Diehl. 25,161. November 11th. (November 23rd, 1910.)

Telegraphic Systems. P. Faiella. 27,510. December 7th. (December 9th, 1910. Addition to 4,920 of 1911.)

Manufacture of Metallic-Filament Incandescent Lamps. Siemens Bros. and Co. (Siemens & Halske Akt.-Ges.) 29,698. December 27th. (Convention date not granted. Addition to 19,077 of 1910.)

1912.

Apparatus for Producing Electric Oscillations Adapted for Wireless Communication and other Purposes. W. Dubilier. 11,091. May 9th.

Telephones and other Apparatus Embodying Exposed Diaphragms. E. A. Graham. 13,768. June 12th.

Makers of Connections to Commutator Segments of Dynamo-Electric Machinery. Siemens Schuckertwerke Ges. 15,662. July 4th. (July 4th, 1911.)

Magneto-Electric Machines for Ignition. W. Hayer. 1,895. January 17th.

Construction of Burglar Alarm. J. H. Lang. 3,282. February 8th.

Electric Incandescent Lamps. R. H. Henderson. 7,148. March 23rd. (March 23rd, 1911.)

Electric Signalling Circuit for Train Despatching and Like Systems. J. C. Field. 7,435. March 27th. (March 30th, 1911.)

Device for Locking Together an Incandescent Electric Lamp of the Bayonet-Capped Type and Lampholder. G. E. Meek. 12,226. May 23rd.

Devices for Ensuring Electrical Continuity in Metallic Conduits for Electric Cables. L. M. Waterhouse and Simplex Conduits, Ltd. 13,079. June 4th.

Automatic Telephone Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,563. June 21st. (Addition to 7,093 of 1910.)

Canada.—The *Times* correspondent at Toronto reports that at the recent annual banquet of the Manufacturers' Association, at Ottawa, Mr. R. S. Gourlay, the new president, said:—"We were asked by British manufacturers if we would favour an increase in British preference." His answer was:—"We would not; and their best course is to cast in their lot with us, and establish branch factories in Canada."

Fire.—An outbreak of fire occurred on Wednesday last week at the fitting shop of the British Insulated and Helsby Co.'s works at Prescot. The roof and a quantity of stores were totally destroyed.